Regulation of Cultivated Meat & Recombinant Proteins in the United Kingdom

Recommendations for Ensuring Safety and Embracing Innovation

By
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Foreword

The UK has a once in a generation opportunity to be a leader in a truly innovative growth industry – alternative proteins. The UK is fertile ground for innovation that will secure the supply of food for the British people during tough times, with a strong ecosystem of scientific research and development, venture capital and SMEs.

However, British innovators are being held back by laws we inherited from the European Union. These laws have stifled competition, allowing countries outside Europe to get ahead, and depriving British consumers of choice. Meanwhile, our closest competitors internationally are getting ahead, leaving British workers vulnerable to cheap imports in future.

This paper identifies the specific challenges, solutions and opportunities for innovators in the United Kingdom growing cultivated and recombinant proteins to make meat and dairy in a different way. It was written in consultation with innovators, policymakers, academics, scientists and investors.

Food security will be the defining issue of the 21st Century. The public has been exposed to increasing food costs due to inflation , whilst British farmers are facing an unprecedented set of challenges, including competition with high-technology and low-welfare alternatives, limited land productivity exacerbated by climate change and economic pressures towards low prices despite rising food costs. Increasingly, they are searching for ways to boost their businesses and secure homegrown supply to feed the nation.

Alternative proteins were put at the heart of the Government's Food Strategy [released earlier this year] for this reason. They are less exposed to inflationary fluctuations and are more environmentally efficient to produce. In that same document, the Government committed to removing EU bureaucracy that currently holds back our agri-food industries in this national strategy document.

I hope that this paper helps with that endeavour, because enabling the British alternative proteins industry to grow will boost GDP by billions of pounds and create tens of thousands of new jobs right across the country.

The UK is ideally positioned to lead the world in food innovation. The alternative proteins industry is an ideal place to start to capture the benefits of Brexit.

It's in our hands to catch up, get ahead and lead the world.

JEREMY COLLER
Chair, Alternative Proteins Association

Executive Summary

The United Kingdom is ideally positioned to be a European leader in food technologies including cultivated meat and recombinant proteins. Cultivated meat and recombinant protein companies are poised to bring their products to market, but are being held back in the European Union by cumbersome regulation. Although the United Kingdom has inherited the same regulatory framework, our separation from the European Union gives us the opportunity to reform and improve the process, ensuring product safety while embracing innovation. The Department for Food, Environment and Rural Affairs recognised this in the recent Government Food Strategy White Paper[1].

In this report, we outline 12 major recommendations to the UK government:

Catching Up

1. **Invest.** Provide the Food Standards Agency with the vital additional resources it needs to perform its new responsibilities and accelerate applications.
2. **Dialogue.** Open a dialogue between companies and regulators, allowing substantial consultation pre-application to discuss detailed requirements**.**
3. **Clarity.** Update and clarify existing requirements, giving companies certainty in the studies required and parameters that should be measured for production processes and ingredients.
4. **Equivalence.** Adopt global standards by recognising approval by other regulators (especially EFSA opinions and EC authorisations, as well as US and Singapore regulators) and standardising approval within UK nations.

Getting Ahead

5. **Streamlining.** Streamline and provide vital resources to the existing process to allow producers a quicker and more straightforward path to market.
6. **Labelling.** Stipulate clear and honest labelling to communicate to consumers with clarity and meaning.
7. **Signalling.** Signal support for innovation by embracing the production, sale, and consumption of alternative proteins.
8. **Exemptions.** Level the playing field with animal products by extending their zero-rate VAT status to include alternative proteins.
9. **Prioritisation.** Prioritise novel foods which are of national strategic importance, for example those which aid food security and Net Zero goals.

Leading the World

10. **Modularisation.** Adopt a modular approval system, reducing redundancy and increasing certainty with respect to specific ingredients and processes.

[1] https://www.gov.uk/government/publications/government-food-strategy/government-food-strategy

11. **Sandbox.** Create a food regulatory “sandbox” where producers and consumers can test products in a supervised safeguarded environment.
12. **Funding.** Increase research and investment funding to develop safe and sustainable food technologies.

Capitalising on our regulatory independence from the EU and adopting these recommendations will help the United Kingdom to position itself as a world leader in alternative proteins.

1. Background

As the United Kingdom embraces life outside the European Union, we are presented with many opportunities to chart our own regulatory course. One of the many areas in which we have inherited the EU's regulatory system is novel foods. The UK's Food Standards Agency has inherited the European Union's novel foods framework, which has been criticised as slow, uncertain, and burdensome[2].

Two industries for which these regulations have proved burdensome are cultivated meat and precision fermentation. Cultivated meat is meat produced from growing animal cells inside a bioreactor[3]. Precision fermentation refers to the use of microorganisms to produce food (e.g. dairy proteins produced by yeast)[4]. Many of the companies pioneering these technologies – including those based in the UK and Europe – are now looking outside the UK and Europe to countries like Singapore, Israel, the US, and Japan for their first markets due to the opaque nature of EU regulations. In particular, the rigidity of the European system could have many cultivated meat and precision fermentation products regulated as genetically modified (GM), which entails a restrictive and uncertain path to market.

Regulation to embrace innovation in food technology could confer many benefits to the United Kingdom. As well as capitalising on our strong science and technology infrastructure to claim a share of the growing global market for new proteins, we can minimise disruption to British farmers[5], buttress our national food security[6], reduce our food system's environmental footprint[7], and mitigate risks to public health[8].

The UK already has a track record of embracing these innovations. In 2013, the Dutch scientist and pioneer of cultivated meat, Professor Mark Post, presented the first cultivated meat hamburger for tasting at a press conference in London[9]. Almost a decade later, in 2022, the Dutch Parliament has only just voted to recommend the approval of cultivated meat tasting, following the confiscation of a cultivated meat sample by the Dutch Food Safety Authority[10]. Following our departure from the EU, Britain has the opportunity to chart a new regulatory course and unlock huge opportunities in protein innovation.

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[2] https://www.foodmanufacture.co.uk/Article/2005/10/06/Novel-foods-speeding-up
[3] https://www.nature.com/articles/s43016-020-0112-z
[4] https://gfi.org/science/the-science-of-fermentation
[5] https://drive.google.com/file/d/1PTIizDD7hiDynkNRtHMVUw77t9dL60oj/view
[6] https://www.frontiersin.org/articles/10.3389/fsufs.2021.753996/full
[7] https://cedelft.eu/publications/rapport-lca-of-cultivated-meat-future-projections-for-different-scenarios/
[8] https://link.springer.com/article/10.1007/s10640-020-00484-3
[9] https://www.bbc.co.uk/news/science-environment-23576143
[10] https://www.forbes.com/sites/danieladelorenzo/2022/03/17/dutch-parliament-approves-cultured-meat-tasting-within-the-netherlands/

In the following sections, we explore a range of practical policy improvements for the safe and effective regulation of cultivated meat and recombinant proteins. Some of these are ‘quick wins’, and reflect changes which can be made within the existing regulatory frameworks. Others are more ambitious and long-term recommendations including legislative change. All of them will take advantage of our regulatory autonomy to position the United Kingdom as a European leader in novel food technologies. Crucially, the recommendations do not compromise on food safety, which remains paramount to consumer adoption and the very future of these industries.

2. Catching Up

In this section, we outline actions that can be taken immediately to catch up with the regulatory standards in other parts of the world.

2.1. Invest resources in the Food Standards Agency

The most important immediate priority is to ensure that the Food Standards Agency (FSA) has the resources it needs to accelerate the processing of novel food applications. While cultivated meat and recombinant protein producers prepare for market, the FSA has found itself with stretched resources and a significant backlog of applications. The government must **provide the FSA with the vital resources it needs to accelerate the processing of novel food applications.**

Brexit has led to both an increase in responsibilities for the FSA and a decrease in resources. A report by the National Audit Office highlighted that the FSA had not only become newly responsible for the regulation of novel foods in the UK, it has also lost access to EU resources including the Rapid Alert System for Food and Food[11]. It is estimated that the FSA requires 65% more full-time equivalent staff just to keep up with international information exchange on food safety incidents[12]. This is in addition to recruiting new talent to process novel food applications.

The FSA's budget has declined year on year[13] in real terms, at the same time as the budgets of other regulatory agencies across the world have been increased significantly. Equally, the House of Commons Public Accounts Committee has argued that Government's requests for all Government Departments to model headcount reductions of 20%, 30% and 40% presents a major threat to the FSA delivering its expanded responsibilities post EU Exit, suggesting it may be necessary to identify where cuts will demand significant changes in regulatory models and capacity.[14] Insufficient funding and resourcing risks the FSA lacking the capacity and the expertise to process new alternative protein approvals at the speed and volume they are required in the coming years. This situation is arguably already happening, as for example mung bean protein isolate is now approved as a novel food in the EU, but is still under risk assessment in the UK[15]. This lack of resources to the FSA has drawn criticism from the chair, Professor Susan Jebb, as well as other UK food

[11] https://www.nao.org.uk/report/regulating-after-eu-exit/
[12] https://www.foodsafetynews.com/2022/05/fsa-dealing-with-staffing-and-data-gaps-after-brexit/
[13]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1043689/Budget_AB2021_Web_Accessible.pdf
[14] https://committees.parliament.uk/publications/30148/documents/174754/default/
[15] https://www.foodnavigator.com/Article/2021/10/20/Eat-Just-mung-bean-protein-gets-novel-foods-nod-Bringing-JUST-Egg-to-Europe-will-be-one-of-the-most-important-milestones-for-our-company

system leaders[16]. The UK government must provide the FSA with the financial and scientific resources it needs to do its job so that British innovators are not delayed in getting to market.

The UK government must recognise the post-Brexit challenges the FSA is facing, and commit to ensuring that the Agency is fully funded and has the resources to do its job. Investing in the FSA, and investing in our ability to process novel food applications will pave the way for the UK to be a European hub for food technology.

2.2. Open dialogue between regulators and producers

One of the most important changes that the government could make to help regulate these new food technologies is to **open a substantive dialogue with producers**. In particular, regulators should be able to **provide advice to applicants on data requirements to support the safety and quality of their novel food application such as toxicology and nutritional testing requirements, composition thresholds, and allergens.** The FSA should establish a dedicated unit where regulators could work with producers to identify and specify product requirements, as well as publish clear guidance for the industry to be used alongside this pre-submission advice.

The process could be made smoother still by having a single point-of-contact liaison at the FSA for companies. Having a single person who is responsible for working with each producer limits the administrative burden on companies and the FSA during this process.

UK regulators can learn from the approach of other regulatory authorities such as the Food Standards Australia and New Zealand, the Singapore Food Agency and the US Food and Drug Administration. In these regions, the regulators have positioned themselves as collaborative and consultative partners rather than gatekeepers. For example, these authorities offer to review draft versions of the dossiers to provide feedback before final submission. Whilst requiring more resources, this helps the applicant to provide a good quality dossier and allows the authority to understand the product, which makes the process more efficient. Their objective is to work with producers to understand the relevant production issues, then define and refine acceptable parameters within which products can be safely approved. The expected time to market in these regions is 10-14 months, compared to a minimum of 18-24 months in the EU.

Japan has also taken a proactive approach to regulating cultivated meat. The government-led Japan Food Technology Research Group launched in 2020 to

[16] https://www.theguardian.com/business/2022/jun/27/uk-faces-significant-risks-to-quality-of-food-imported-post-brexit-says-report

investigate the regulatory landscape for food technology. In addition, the Japan Association for Cellular Agriculture collaborates with industry, government, and academia within the Centre for Rule-Making Strategies.

EFSA recently published a horizon-scanning report to identify future requirements for risk assessments in regulation[17]. The report presented consultations with regulatory scientists and international stakeholders, but neglected to include the views of industry, meaning that it omitted a lot of material, and was not as impactful as it could have been with industry insights.

These approaches recognise that regulating food technology is complex, and is dependent on cutting-edge and often proprietary science. Regulators cannot be expected to have the expertise to be able to issue specific regulation *without* being able to consult with producers – particularly given the scarcity of scientific resources currently available to the FSA. Likewise, it is not possible for producers to develop their processes without some idea of what the acceptable production parameters are. A dialogue between producers and regulators is simply necessary.

2.3. Update and clarify regulatory requirements

One of the major issues facing cultivated meat and recombinant protein producers and regulators is the novelty and rapid rate of technological progress in the field. There needs to be **specific thresholds for acceptable levels of certain ingredients, declarations on the use of specific processing techniques, and standardised methods for safety testing, monitoring and reporting in production**. However, many of these specifics relate to technologies which did not exist just a few years ago. It is therefore not surprising that existing regulatory frameworks are often vague and outdated. Scientific guidance on regulation of these products must be updated.

Identifying issues of potential regulatory concern and **specifying parameters relating to those issues** needs to be done **in collaboration with producers** (see next section). Many of the social and regulatory questions about cultivated meat are downstream of technological questions[18]. For example, it is important to clarify the conditions under which the cell culture medium is regarded as an ingredient or a processing aid in cultivated meat. Understanding of these issues would be best achieved in open dialogue with producers who have a detailed understanding of the issues at hand. This would be mutually beneficial, as regulators can benefit from the scientific expertise of producers.

[17] https://www.efsa.europa.eu/en/supporting/pub/en-7297
[18] https://academic.oup.com/jas/article/98/8/skaa172/5880017

There are important implications of the following regulatory issues, which are not clear under the existing framework. Clarity on these issues would increase certainty for food technology producers and investors. This is a non-exhaustive list of some of the questions producers have.

A. We understand that cultivated meat and precision fermentation products are to be regulated as novel foods; is there scope for them to also be regulated as biotechnology products, genetically edited, agricultural technologies, animal products, and/or anything else for regulatory purposes? What other regulations and regulators are likely to be involved?
B. In precision fermentation, what is considered a genetically modified microorganism as a processing aid and when does it become a genetically modified food? We understand final products should be free of host strain DNA to be classified as a novel food, but what are the requirements around the presence of host strain proteins?
C. What changes to ingredients or production methods are considered substantial enough to require a dossier to be amended or resubmitted?
D. What specific composition thresholds are acceptable for a range of specified ingredients, such as growth factors? Benchmarks are given, for example, for animal feed[19], and similar benchmarks for common growth factors could be given for alternative protein products.
E. What are the existing guidelines on the use/residue of antibiotics in the production processes for novel foods? To what extent can they be used in the production of cultivated meat, seafood and other products?
F. To what extent can human recombinant proteins be used in culture media?
G. Could genetically modified cell lines be used as an ingredient in a sustainable protein product without that disallowing that product from being regulated as a novel food? Separately, can genetically modified components be used as a processing aid in the culture medium for cultivated meat and seafood? What are the conditions and requirements in each case?
H. Under what conditions are culture media classified as an ingredient in contrast to being treated as a processing aid?
I. Under what conditions can prototype products be taste tested by employees and/or members of the public before they receive full market approval?

Demonstrably, answering many of these questions requires specific technological expertise. In the Singaporean model, regulation and guidance is established in collaboration with producers, and then continually updated and clarified to reflect technological progress. Achieving clarity on important regulatory issues is best achieved in collaborative dialogue with producers.

[19] https://ec.europa.eu/environment/eussd/smgp/pdf/PEFCR_feed.pdf

We note the existence of several regulations which may be relevant to cultivated meat and recombinant protein companies currently. EC2015/2283 on Novel Foods[20], EC853/2004 on hygiene guidelines for animal-derived food businesses[21], EC1333/2008 on food additives[22], and the ACNFP guidance on taste tests[23] are all potentially applicable.

Further, there are several existing standards and certifications which may be relevant to cultivated meat and recombinant protein companies. FSSC22000[24] & ISO22000[25] (to demonstrate a compliant food safety management system), as well as ISO9001[26] (to demonstrate a compliant quality management standard), could apply. Currently, the only requirement is to have in place a plan for Hazard Analysis and Critical Control Point (HACCP).

2.4. Adopt global standards

One of the major common-sense regulatory reforms for cultivated meat and recombinant proteins is **international equivalence**. The development and adoption of a **global standard** for novel proteins will reduce regulatory redundancy, increase global trade, and ensure consumer confidence.

Without adopting some degree of international equivalence, regulators in each country are likely to find themselves reinventing the wheel. Many of the specifications of production facility requirements or acceptable thresholds for given ingredients are likely to be applicable; even if the specific levels differ between regulators, the parameters of interest will be largely the same.

Regulators can seek to actively learn from the experiences of other regulators and industry groups. For example, lawmakers in the USDA and FDA have formally consulted with regulators from Singapore's A*STAR on cultivated meat. UK regulators should be empowered to embark on fact-finding missions and have active discussions with regulators who are further advanced in their understanding of the technology. Consultations with other regulators, as well as with industry and the public, are vital to forming policy.

Singapore has taken a proactive approach to regulation equivalence. Their regulatory framework explicitly states that the Singapore Food Agency will consider dossiers from the USA, Australia, New Zealand, and the EU. The Singapore Food

[20] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32015R2283
[21] https://www.legislation.gov.uk/eur/2004/853/article/1
[22] https://www.legislation.gov.uk/eur/2008/1333/contents
[23] https://acnfp.food.gov.uk/sites/default/files/mnt/drupal_data/sources/files/multimedia/pdfs/acnfp9201.pdf
[24] https://www.fssc22000.com/
[25] https://www.iso.org/iso-22000-food-safety-management.html
[26] https://www.iso.org/iso-9001-quality-management.html

Agency rapidly updated the regulations around cultivated meat tasting to reflect changes made in the Netherlands and to include other updates to assist applicants based on their recent learnings. Israel also takes overseas approvals into account, and they approve technologies already approved in at least two authorised countries.

The current situation vis-à-vis regulatory equivalence with the EU is particularly egregious. Currently, producers must pass through the exact same process for EFSA and the FSA separately. While we have 'inherited' approval of novel foods which were approved by the EU before Brexit, we currently do not recognise EU approvals on an ongoing basis. This has led to a situation where some products are approved in the EU, but not in the UK, despite the exact same set of standards[27]. There is no reason for UK regulators not to recognise EU approval on an ongoing basis given the current standards.

As well as recognising approval from countries outside of the United Kingdom, countries inside the United Kingdom should recognise each others' approval. The current devolution of agricultural and food policy could mean that cultivated and fermentation-derived products which are approved in England, for example, will require additional approvals in Wales, Scotland, and Northern Ireland[28]. This would create unnecessary administrative burdens and could send mixed signals to consumers.

That said, there is recent precedent for products authorised as novel foods in England (namely, flavoured e-cigarettes) being granted equivalent authorisation in Scotland and Wales[29], so a similar route may exist for alternative proteins.

One strategy for interacting with international approvals is to separate approval of production and consumption. This would enable UK companies to export products, even if they are not yet approved for consumption here. Likewise, it could enable UK consumers to import products, even if they are not yet approved for production here.

3. Getting Ahead

In this section, we outline measures that can be taken to further improve the regulatory environment for alternative protein producers in the UK.

3.1. Streamline the existing approval process

[27] https://www.foodnavigator.com/Article/2021/10/20/Eat-Just-mung-bean-protein-gets-novel-foods-nod-Bringing-JUST-Egg-to-Europe-will-be-one-of-the-most-important-milestones-for-our-company
[28] https://www.bbc.co.uk/news/uk-scotland-61768920
[29] https://www.legislation.gov.uk/ssi/2022/168/contents/made

There are real opportunities to **streamline the existing novel foods regulation** process and provide British companies with an advantage in getting to market.

The United Kingdom is already embracing food regulatory independence, with England allowing the use of gene-edited tomatoes to boost Vitamin D[30]. The use of other gene-edited crops could provide an affordable and scalable way to produce growth factors, some of the most expensive ingredients of cell-culture media. Notably, this technique may not be allowed in the EU, conferring a distinct advantage to producers in the UK.

While the specific production parameters must be defined in consultation with producers, the inherited European Union novel foods framework contains some stipulations which are unnecessary, and place undue burdens on producers. By making some small changes to the existing process, the United Kingdom can create an approval process which is easier to navigate without compromising safety.

Some practical changes that could be made to streamline the existing process are:

A. Increase transparency of the process by clarifying the scope of regulators' ability to pause applications to issue additional information requests with unpredictable outcomes, or to move the goalposts by updating requirements after applications have been submitted;
B. Apply an innovation principle, giving due consideration to the potential benefits of new products as well as the risks associated with existing products (see Section 3.5);
C. Streamline testing requirements by reducing the quantity of required test samples and embracing new *in silico* toxicological testing methods.

These represent minor changes to the existing European Union framework which could make a major difference for producers of cultivated meat and recombinant proteins. By cutting the time to market in the UK compared to the EU, we are in a position to benefit from a significant first mover advantage.

3.2. Ensure clear and honest labelling

There are two major issues with respect to labelling cultivated meat and recombinant protein products. First, there is the question of whether such products will be allowed to be marketed as meat. Second, there is the question of what kind of labels such products will be required to carry. We address both questions here, proposing that the United Kingdom should follow the Singaporean model of **permitting cultivated chicken to be marketed as chicken**, whilst **requiring it to be identified as being cultivated**.

[30] https://www.bbc.co.uk/news/science-environment-61537610

There has been recent debate in Europe about the suitability of ‘meat-like’ product labels for plant-based products (e.g. vegan burgers, vegetarian sausages). While a handful of politicians moved to prohibit the use of such labels on the grounds that they would mislead consumers, the European Parliament as a whole rejected those proposals in 2020, ruling that these products could retain their meaty labels[31].

Although the move to ban meat-like names for plant-based products was dropped by MEPs, they concurrently voted for further restrictions on plant based dairy labelling, proposing to go even further than the existing ban on terms such as ‘cheese’ and ‘milk’. However, they U-turned on this decision a year later, abandoning the Amendment and opting to keep the already-restrictive status quo in place[32]. Now, another year later, France has introduced their own national restrictions on labels for plant based meat, despite the EU decision[33].

The regulatory change in Europe reflects some important underlying truths with respect to the labelling of these products. First, research has demonstrated that consumers are not more likely to mistakenly believe that plant-based products come from animals if they use label terms usually associated with animal products[34]. Second, in practice, consumers use terms like ‘soy milk’ (rather than ‘soy-based milk alternative’) and avoiding the use of these labels actually increases consumer confusion about the products’ taste and uses[35]. Third, it has been demonstrated that consumers are more willing to eat meat substitutes when they use meat-related labels[36].

European regulators ultimately allowed the use of meat denominations for plant-based products, and the decision to ban the use of dairy names dating back to the 1980s could well be re-evaluated in the coming years The case for allowing cultivated meat and precision fermentation-derived dairy products to use these labels is even stronger, since the ingredients are similar. One of the implications of this is that people who are allergic to meat, seafood, or dairy products are also likely to be allergic to cultivated/fermentation-derived meat or seafood/dairy products respectively. If these products are not appropriately labelled as meat, seafood, or dairy, a consumer with allergies might purchase them and have an allergic reaction.

At the same time, it is reasonable that cultivated meat and fermentation-derived dairy products are required to carry labels which identify their production methods. This

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[31] https://www.nytimes.com/2020/10/23/world/europe/eu-plant-based-labeling.html
[32] https://www.foodnavigator.com/Article/2021/05/26/Europe-drops-Amendment-171-allowing-for-creamy-and-buttery-plant-based-dairy
[33] https://www.foodbev.com/news/france-to-introduce-plant-based-meat-naming-restrictions-in-october/
[34] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3727710
[35] https://www.sciencedirect.com/science/article/pii/S0924224420305501
[36] https://www.sciencedirect.com/science/article/pii/S0950329321002950

would be beneficial for consumers, who largely agree that cultivated meat products should be required to be labelled as such[37]. It would also be beneficial to producers insofar as it would increase long-term trust in the industry and decrease the likelihood of public outcry or conspiracies.

Moreover, such labels could double as certificates of provenance. Research has noted that there could be attempts to sell conventional meat as if it were cultivated meat, and recommended the development of a 'protein tracker' to verify the provenance of any meat, analogous to trackers used in the alcohol industry. Such a system could clearly label all meat and dairy products as cultivated, plant-based, or animal-based. Not only would this avoid confusion about the provenance of any products, it would also ensure a level playing field in terms of labelling requirements.

With respect to nomenclature, studies have shown that terms like 'artificial' or 'lab grown' meat tend to be off-putting to consumers, as well as giving them a false perception of where their food is produced (as at scale, these products will not be produced in laboratories). Equally, some suggested industry terms such as 'clean' or 'craft' meat tend to be unclear[38,39]. 'Cultured' and 'cultivated' meat represent a good balance of clarity and appeal, are widely-used terms within the industry, and are used by regulators around the world[40].

Labelling is one area in which EC853/2004 on the hygiene of food from animal origins may apply, but will likely need amendment. For example, these laws stipulate labels about the part of the animals' body and the area where the animal was farmed – these are not applicable in the case of cultivated meat, but other information may be required. The UK Government should consider, in its evaluation of derived EU law, updating this regulation to account for this new innovative method of producing meat.

In summary, regulations should stipulate that cultivated meat and fermentation-derived dairy products can be marketed as meat and dairy respectively, and their production methods should be clearly indicated on the packaging. For the avoidance of confusion, and to ensure a level playing field, regulators could consider introducing protein trackers to indicate provenance for all types of meat product.

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[37] https://www.sciencedirect.com/science/article/pii/S0309174014005014
[38] https://gfi.org/images/uploads/2020/01/Jan-2020-Updated-2018-Cellular-Agriculture-Nomenclature-Report.pdf
[39] https://www.sciencedirect.com/science/article/abs/pii/S0195666318310948
[40] https://gfi.org/blog/cultivatedmeat/

3.3. Signal support for food innovation

An easy quick win is for politicians to **signal support for cultivated meat and other food technologies**. For example, in 2020 Benjamin Netanyahu became the first world leader to eat cultivated meat, commending it as 'delicious and guilt-free'[41].

This kind of positive signal from political leaders can benefit alternative proteins in at least two ways. First, such signals give producers and investors confidence that the government is open to fair regulation of innovative food technologies. Second, seeing political leaders endorse and personally consume the products of food technology innovation is likely to increase public acceptance[42].

The image of the British Prime Minister eating cell-cultivated British bangers would send a clear signal to British consumers that this is a safe and aspirational British product, and to food technology companies around the world that the United Kingdom is open for business. As Singapore has positioned itself as a gateway into Asia for food technology companies, post-Brexit Britain can position itself as the gateway into Europe. Geographical proximity to Europe and a regulatory framework which is similar, but allows more flexibility, would position the United Kingdom as an alternative protein launchpad for Europe.

3.4. Implement zero-rate VAT on alternative proteins

Whereas a standard VAT rate of 20% applies to most food products, several foods are not subject to VAT. These 'zero-rated' foods include meat, poultry, fish, and milk[43], among others. While some types of plant-based milk can be zero-rated, the standard rate applies to most plant-based products, and there are currently no specific exemptions for animal product analogues. The UK should **remove the tax penalty on alternative proteins by extending current zero-rate VAT on meat and dairy to include meat and dairy alternatives**.

Given that there is a zero-rate VAT on animal products, it makes sense to extend this to all alternative proteins. Alternative proteins are typically healthier and better for the environment than animal products[44,45], yet they are subject to tax penalties rather than tax advantages. This situation is the equivalent of granting road tax exemptions on diesel vehicles while levying a tax on electric vehicles.

Tax exemptions for other innovations with social benefits have been discussed. For example, the Local Government Association has advocated for VAT on e-cigarettes

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[41] https://www.foodprocessing.com/industrynews/2020/netanyahu-tastes-cultivated-steak/
[42] https://www.sciencedirect.com/science/article/pii/S0195666321006267
[43] https://www.gov.uk/guidance/food-products-and-vat-notice-70114
[44] https://www.mdpi.com/2072-6643/13/12/4225
[45] https://www.sciencedirect.com/science/article/pii/S0959652621013962

be cut from 20% to 5%, bringing them in line with nicotine gum and patches[46]. The idea is to encourage prosocial behaviours by providing tax advantages which give consumers a financial incentive towards behavioural change.

In the case of alternative proteins, we are not advocating for a tax advantage, but rather for the removal of the current tax disadvantage. By making alternative proteins zero-rated, the government can level the playing field with animal products and ensure that the tax system does not penalise prosocial innovation.

3.5. Prioritise new foods of national strategic importance

The FSA does not currently prioritise any particular applications. Applications are processed as they are submitted. This means new applications will join a queue behind a host of flavourings, oils, and CBD products. However, it is clear that some applications - particularly those relating to new foods - are more important than others because they help deliver on national strategic objectives.

For example, alternative proteins will directly help the Government reach its climate change and Net Zero goals, as well as secure a number of targets for innovation and job creation, public health and food safety, and national food security. It makes sense, therefore, that such products of national strategic importance would be prioritised over products which only add taste or other novelties.

During the COVID-19 pandemic, we saw the great benefits of prioritising approval for certain medical technologies. With the current risks to UK food supply, the Government should take a similar approach for food technologies, so that those with the most potential benefits are treated as a priority by regulators.

There are several ways that the FSA could prioritise alternative proteins over other novel food applications. First, the FSA could allow novel food products with substantial proven benefits to 'skip the queue' and receive authorisation first, regardless of other less important technologies which may have applied before them. Second, the Government could create a specific unit within the FSA which is ring-fenced for approving alternative proteins; deploying a broader understanding of national policy objectives to provide a more holistic review of these products.

Prioritising regulatory approval for alternative proteins makes sense in terms of the UK's key strategic priorities and would bring the UK food approval system in line with its medical approval system, business, growth and environmental goals.

[46] https://www.independent.co.uk/business/government-urged-to-cut-vat-on-vaping-products-to-5-b2031621.html

4. Leading The World

In this section, we highlight more ambitious longer-term policy changes which can position the UK as a world leader in alternative proteins, and should be reflected in the Government's ongoing review of the UK Novel Foods Framework.

4.1. Adopt a modular approval process

One of the major problems with the existing novel foods approval process is that it is inflexible. Risk assessment requirements can be changed even after applications have been submitted, and rejected applications mean that producers have to restart the 18–24 month process. At the same time, several companies are likely to have applications under consideration which cover many of the same innovations. One proposed solution to this is a system of **modular approval** and a **public database of approved safe processing methods and ingredients**.

Adopting a modular approval approach would enable companies to have specific parts of their production process and specific ingredients approved as safe, and develop other parts of the process around that. In practice, this would mean more and narrower applications, which could make review and approval quicker. Moreover, if some ingredients or processes are deemed unsuitable, producers can specifically alter parts of the process 'downstream' of this, with the certainty that processes 'upstream' are unaffected. This approach would also prevent the need to restart the entire approval process when an application is rejected due to a problem with a small part of it.

Approved processes and ingredients could be added to a public database so that all producers can benefit from the knowledge of approved processes and ingredients. This could also be a mechanism for encouraging sharing of, or adding value to, relevant intellectual property. If companies are applying for public approval of certain ingredients or processes, this information being public is likely to catalyse innovation elsewhere.

A modular system would also enable regulation around specific processes or ingredients to be updated and refined as they are developed. The rapidly changing nature of technology in this space is likely to mean that a years-long unmodulated approval process would result in approval of technology which is almost obsolete. A more nimble modular system would be more straightforward to update as the technology evolves.

The US has adopted a somewhat modular approach to cultivated meat approval. The USDA regulates production pre-cell-harvest, while the FDA oversees the process post-cell-harvest. There could be an analogous situation in the UK such that cultivated meat producers are subject to regulations applicable to both novel foods

(i.e. the FSA) and meat products (i.e. the Meat Hygiene Service). While this provides some more certainty for producers, there are certainly untapped opportunities for modularised authorisation of specific ingredients and processes on a publicly available database.

4.2. Create a food technology sandbox

One innovative approach which would allow product development and testing is a **food technology regulatory 'sandbox'**. This would be analogous to the sandbox introduced by the Financial Conduct Authority in 2021. Sandbox systems provide a controlled environment where new products can be tested and regulations developed with safeguards for consumers.

Sandbox systems can reduce time-to-market, lower costs, and provide better access to finance. They can also provide a valuable learning environment for regulators, as well as producers: companies developing and testing products enables regulators to identify appropriate safeguards and requirements.

The UK has a history of embracing innovative food testing. When the Dutch scientist Professor Mark Post revealed the world's first cultivated hamburger, the public taste test in 2013 took place not in the Netherlands, but in London. A regulatory sandbox would be in keeping with the UK's history of embracing food innovation, and could consolidate the UK as a European hub of food innovation.

One variation of this concept is to pre-approve particular production facilities. Again, this is an approach used by Singapore – products are approved if they are produced in an approved facility[47]. This approach has the advantage of providing small-scale production capacity for new companies to produce batches for testing. This could otherwise be prohibitively expensive, particularly if companies had to set up entire manufacturing facilities before getting any regulatory approval.

Another version of the food technology sandbox can be seen in Israel, where 'The Kitchen' in Tel Aviv provides a test kitchen and restaurant where members of the public can sample cultivated meat pre-approval. This enables producers to test and refine their products in an environment where the relevant regulators can observe and learn about the production process once there is sufficient initial evidence of safety.

At present, production facilities may be subject to EC853/2004 on the hygiene of animal-derived products. These regulations are often irrelevant for alternative proteins – for example, many of the requirements relate to the safe handling of

[47] https://www.straitstimes.com/singapore/environment/worlds-first-commercial-cultured-meat-production-facility-operational-in

potentially-contaminated animal products, the separation of meat from live animals, etc. Therefore, this framework is likely inappropriate for alternative proteins regulation.

4.3. Fund protein research and innovation

In addition to ensuring a clear regulatory landscape, investment into relevant R&D is another critical component to ensure a thriving domestic alternative protein industry. The United Kingdom must follow Canada, the US, China, Israel, and other major world governments in **allocating substantial public funds to research and development of alternative proteins**[48].

The UK's recent Government food strategy white paper contains a commitment to £120 million in research funding for the food system through UK Research & Innovation (UKRI)[49]. While this is a commendable investment, the timescale is unclear, the scope is too broad, the total amount is not nearly enough.

First, there is no clear timeline for dissemination of this research funding. While £120 million may be a reasonable investment in a single year, it reflects a trivially small amount if the investment is spread over several years, or over a parliamentary period. In fact, without clarification, this might commit as little as £24 million a year over 5 years. In fact, it is not even clear whether the £120m funding committed is 'new' money, or is set to be taken from pre-committed funding streams.

Second, the funding covers the whole food system, with no ring-fenced funding for alternative proteins. This means that the total allocated to alternative proteins is likely to be far less than this. Of the funding that has been allocated to this area, some is only tangentially related to developing alternative proteins[50,51].

Finally, the £120m figure is too small. The figure represents about half of the £225 million investment recommended by the Good Food Institute[52], and pales in comparison to the capital being raised in industry[53,54]. Even if all of the committed funding went to alternative proteins, it would be less half of the funding allocated to the therapeutics industry through the Life Sciences Fund[55], less than half of the £270

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[48] https://www.fairr.org/sustainable-proteins/policy-regulation/
[49] https://www.gov.uk/government/publications/government-food-strategy
[50] https://www.ukri.org/news/healthy-food-healthy-people-healthy-planet/
[51] https://apply-for-innovation-funding.service.gov.uk/competition/1159/overview/52be2e33-0daa-4def-a11b-4ca66d856753
[52] https://drive.google.com/file/d/19G3OVv_fNrygqCsEUa8AoVG6b6Zki3lt/view
[53] https://www.thegrocer.co.uk/finance/the-biggest-funding-rounds-in-cultured-meat-startups/665495.article
[54] https://www.wsj.com/articles/lab-grown-meat-producer-upside-foods-raises-400-million-11650544200
[55] https://www.gov.uk/government/news/260-million-to-boost-healthcare-research-and-manufacturing

million funding allocated to the farming innovation program, and about 20% less than the government funding for plant-based foods in Denmark[56].

Meanwhile, the Netherlands, a European hub of alternative proteins, has attracted vast foreign investments - €50M investment from Upfield, $94M research facility from Unilever, and a manufacturing facility worth millions from Beyond Meat. The Netherlands recently announced €25 billion to buy out livestock farmers, suggesting a radical shift away from animal agriculture in one of Europe's largest food exporters[57].

As well as ensuring that UK companies can keep up with international competitors who benefit from substantial state subsidies, the terms of such funding can be set such that other goals are achieved. For example, Canada's $100 million investment in the plant-based food company Merit Functional Foods is contingent on the company using 100% Canadian crops, providing a boost to the agricultural sector[58].

As well as limited opportunities to obtain public investment, UK companies also face barriers to foreign investment due to the National Security and Investment Act. The Act, which came into force in January 2022[59], places unnecessary restrictions on foreign investment into UK alternative protein companies, giving government sweeping powers to intervene in foreign investment on national security grounds. It has not been made clear to companies what the standards are for investments to adhere to.

5. Conclusions

Around the world, the protein transition is already well underway. Consumers, producers, and governments are increasingly recognising the need to move away from animal products, and are increasingly eating and investing in alternative proteins.

Although the UK is currently lagging behind global competitors in alternative protein investment, its separation from the European Union provides it with a unique opportunity to establish itself as the European hub of alternative proteins, and a gateway into Europe for alternative protein companies and investors around the world. We recommend a range of short-term and long-term policy solutions to ensure safety and embrace innovation in alternative proteins.

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[56] https://gfieurope.org/blog/denmark-plant-based-investment-in-climate-agreement/
[57] https://www.theguardian.com/environment/2021/dec/15/netherlands-announces-25bn-plan-to-radically-reduce-livestock-numbers
[58] https://www.ic.gc.ca/eic/site/093.nsf/eng/00012.html
[59] https://www.gov.uk/government/collections/national-security-and-investment-act

Short-term recommendations include updating and clarifying existing regulations, opening a pre-application dialogue between producers and regulators, streamlining the existing process, permitting clear and honest labelling, and signalling support for innovation. Long-term recommendations include adopting a modular approval process, observing global regulatory equivalence, creating a food technology regulatory sandbox, and investing in food technology research and development.

Adopting progressive and nimble regulation of alternative proteins could position the United Kingdom as a European hub of alternative proteins, and consolidate long-term food security while simultaneously advancing environmental sustainability and economic growth in the UK.

The Alternative Proteins Association (APA) is the largest association of its kind in Europe, designed to promote the value of alternative proteins in the UK. The APA aims to tackle the challenges presented by food insecurity, climate change, the cost of living and intensive farming by helping the UK become a world leader in alternative proteins and inspiring collective action.

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