COMMITTEE PAPER FOR DISCUSSION **ACNFP/119/07**

ADVISORY COMMITTEE ON NOVEL FOODS AND PROCESSES

FOOD 2025

Issue

1. As part of its horizon scanning role the Committee is asked to:

- consider the questions posed in this paper in relation to the future of the food system and of consumers' interests in relation to food;
- determine the innovations in relation to new foods or food ingredients, or developments in food production, it sees as having an impact on food and the food chain by the year 2025; and
- comment on the implications these impacts may have for the safety, affordability, security and sustainability of the food system.

Background

2. The focus of the FSA strategic plan for 2015-2020 (www.food.gov.uk/about-us/about-the-fsa/strategicplan) is to put consumers first, ensuring food is safe and that we have access to an affordable healthy diet and can make informed choices about what we eat, now and in the future.

3. The commitment in the FSA strategy to the best food future that can be delivered for consumers, will initially involve working with a range of partners who have a strong stake in the public dialogue to develop a shared understanding of what the impact of medium-term changes to the global food system could be on consumers.

4. The strategic plan also includes a commitment to improve the way the Agency uses horizon scanning to better protect the longer term interests of consumers in relation to food. As part of this commitment the Agency is asking all the scientific advisory committees (SACs) to carry out horizon scanning exercises within their own areas of expertise to help FSA to better understand what the future might hold for the food system and for consumers' interests in relation to food.

5. The outputs from these activities will be used to inform an event in February 2016 which aims to open up a conversation with experts across all disciplines and areas of interest on the impact of the future of food on consumers in terms of

emerging risks. In turn, this will inform FSA policymaking and bring the Agency's unique contribution – the interests of consumers – into the global food debate.

6. Other Government projects that have considered aspects of the food system and/or wider factors and developments which might affect food futures include:

   - The Ministry of Defence: Global strategic trends to 2045. https://www.gov.uk/government/publications/global-strategic-trends-out-to-2045
   - The Government Office for Science: The future of food and farming: challenges and choices for global sustainability https://www.gov.uk/government/collections/global-food-and-farming-futures
   - Work to understand and exploit the potential of key technologies for the UK: http://www.policyexchange.org.uk/images/publications/eight%20great%20technologies.pdf[1]

7. Issues that are highlighted in these and similar studies include the challenges of feeding a growing world population. The problem intensifies with people especially in developing countries becoming more affluent and therefore resulting in increased consumer demand for animal protein. The potential impacts of climate change, and of peoples' reactions to it in terms of mitigation of, and adaptation to, its effects, in influencing where and how food is grown could also influence factors affecting the direction of food innovation. This is also linked with changes in the availability of water and key plant nutrients such as phosphorus. These reports also highlight the potential of new technologies to address these issues and more generally to change the way food and other systems operate.

8. The practical challenges of making food available go hand in hand with the challenges and influences on the food industry from trends in consumer demands. Currently demands for healthy and convenience foods are influencing developments of products which provide a nutritional or health benefit. How this develops in future years will be of interest to both regulators and consumers. The drive for healthier foods may lead to extracts of nutrients or non-traditional ingredients being used to ensure the same consumer experience but with more beneficial nutrients or fewer calories.

9. It is recognised that traditional technologies will have a role in meeting challenges set by the supply chain and consumers. It can be foreseen that with increased pressure on resources there will be a need to be innovative with current

[1] Reports and analysis on each of the technologies include those on:
Life sciences, genomics and synthetic biology: https://www.gov.uk/government/publications/eight-great-technologies-life-sciences-genomics-and-synthetic-biology
Agri-science: https://www.gov.uk/government/publications/eight-great-technologies-agri-science
Big data: https://www.gov.uk/government/publications/eight-great-technologies-big-data
Internet of things: https://www.gov.uk/government/publications/new-eight-great-technologies-internet-of-things

ingredients beyond reformulation. For example recycling parts of food products not currently widely consumed or using innovatively food that is currently wasted. With greater global trade we may see the emergence of new plants or microorganisms that are available elsewhere in the world and will now need to be considered as a potential food source for the EU population.

Emerging or near market technologies

10. In recent years the Committee has considered a number of emerging or near market technologies that have a role; or potential role in food production. These include: cloning, nanotechnology, new protein sources (e.g. insects and in vitro meat production), GM animals and new techniques for the genetic manipulation of plants.

11. Other areas of potential importance include synthetic biology, and 3D printing; two areas where the potential implications for food production have not yet been fully considered by the ACNFP. Explored below are some of the known areas where innovation could lead to products being on the market.

Cloning

12. The ACNFP has previously considered the status of food produced from cloned animals (e.g. ACNFP/101/12). While there is a consensus that such food does not pose a safety risk, cloned animals are subject to the novel food regulation as cloning is considered a non-traditional breeding technique.

13. Cloning may well become a routine technique in the near future, but the initial uses may well be confined to the cloning of high worth, including genetically modified, animals.

Nanotechnology

14. The ACNFP has looked at the issue of nanotechnology in food in the past (e.g. ACNFP/70/4; ACNFP/76/3) and contributed to the Government response to the House of Lords report on nanotechnologies and food in 2010 (ACNFP/96/7).

15. In April 2011 the European Food Safety Authority published guidance on risk assessment of engineered nanomaterials in food and feed. This describes the information that is needed to complete an assessment and provides clarity to applicants who seek authorisation of nanomaterials as food ingredients, food additives or food contact materials. The guidance describes the appropriate testing methods to be used depending on various criteria.

16. Since then the Agency has kept a watching brief in relation to food uses of nanotechnology, but few new products have appeared on the market; one

exception being a food supplement that contains the nutrient Co-enzyme Q10 in nano-form. In addition, EFSA has carried out risk assessments on two nanomaterials; one is an additive for use in food plastics (titanium nitride) and the other is a food supplement consisting of colloidal nanoparticles of silver. The lack of such products on the market may change in the future if food companies identify potentially lucrative market opportunities.

GM and new techniques for the genetic manipulation of plants

17. The next generation of GMOs is beginning to emerge and these include crops with nutritionally enhanced compositional profiles as well as others that can survive extreme environmental conditions.

18. The new techniques of genetic manipulation in question (reviewed by a Commission working group under the GM deliberate release Directive 2001/18/EC) have previously been considered by the ACNFP (ACNFP/105/7). The main (seven) techniques listed by the working group include: oligonucleotide directed mutagenesis, zinc finger nuclease directed mutagenesis, cisgenics, grafting, agro-infiltration, reverse breeding and RNA dependant DNA methylation. All these techniques are being used either experimentally or in the development of commercial products, mostly through the genetic manipulation of different plant species. The status of these techniques in relation to the scope of the GM regulations is still being considered by the Commission.

GM animals

19. The Committee reviewed the EFSA guidance document for the risk assessment of GM animals in 2011 (ACNFP/103/6). This was produced in anticipation of applications for the authorisation of GM animals but, to date none have been submitted in the EU and there are no GM animals authorised for food use anywhere in the World.

20. In the USA a GM salmon, the AquaBounty salmon has been declared as safe for food use by the FDA, but has not yet been authorised due possibly to doubts about the environmental risk assessment, or to political considerations.

21. This particular salmon contains a copy of a growth hormone gene that allows the salmon to grow continuously throughout the year, thus halving the time taken to reach marketable size.

Synthetic biology

22. There is no generally accepted definition of synthetic biology which means it can be difficult to determine the boundary with genetic modification. A recent report from Fera commissioned by the Agency and published in 2014 concluded that all identifiable food applications referred to by the developers as synthetic biology products could be described as genetically modified; although as they were purified chemicals produced by GMMs in vitro (flavourings etc.) they are outside the scope of the GMFF regulation.

23. The goal of synthetic biology is to produce living organisms from basic chemical components, but more modest applications involve engineering the metabolic pathways of microorganisms to produce more complex chemicals, including those for food use. As the technology develops more sophisticated manipulation of microbial genomes will allow the development of further high value products.

New protein sources

Historical perspective

24. At present, the best known novel alternative to meat as a protein source is a mycoprotein produced by the fungus *Fusarium venenatum*. This product was developed by Marlow Foods and, following a comprehensive safety evaluation by the UK regulatory authorities in the early 1980s, this product was first marketed in the UK in 1985 under the brand name Quorn.

25. A wide range of food products containing Quorn are now available and the mycoprotein is now well established as a product in the UK and across the world and is consumed widely as a meat substitute. To date no other similar products (non-meat protein sources) have been submitted for authorisation as novel foods.

In vitro meat production

26. In vitro cultured meat was first brought to the attention of the Agency through a horizon scanning project in 2008. The process makes use of stem cell techniques that were initially developed for medical purposes. Stem cells harvested from animals are cultured in vitro to produce large numbers of muscle cells, which can be made into a “meat-like” product. Before such a product could be commercialised it would require authorisation as a novel food.

27. While there has been some success with this technique, the technology does not currently enable meat to be produced in a recognisable form. While it is possible to produce cells that divide through many generations, these can only be formed in small groups as they lack the network of blood vessels that would be needed to carry nutrients into the body of a larger muscle mass.

28. The 2008 FSA-funded review of emerging food technologies did not identify 'in vitro meat' as a technology that is approaching commercial viability, referring to issues related to consumer acceptance of this type of product. The financial cost of cultured meat has also been highlighted in media reports. Press articles from 2011/12 refer to the cost of 500g of in vitro meat being around £212,000. Other figures suggest that the production of 250g of in vitro 'beef' would cost in the region of $1 million (£0.64m). With commercial backing this could fall to around £3500 per tonne, which is approximately twice the cost of conventional unsubsidised chicken meat production in the EU.

29. A recent review of the technology points out that muscle tissue is highly metabolically active and in vitro production is hampered by the lack of the homeostatic mechanisms that remove metabolic products and provide a steady supply of nutrients in vivo. In addition to meeting the basic requirements for cell growth, the properties of normal muscle tissue rely on regular contraction of the muscles, which can be reproduced in vitro by electrical stimulation. While it may be possible to produce small quantities of meat-like tissue in the laboratory, scaling this up for commercial use presents significant challenges that are as yet unexplored. Also, a number of characteristics of conventional meat reflect metabolic reactions that take place post-slaughter and it is unknown whether the same reactions will occur in cultured meat. Overall, the review concludes that in vitro products are more likely to resemble processed meat products, rather than traditional cuts of meat.

30. The most recent press reports indicate that researchers in the Netherlands believe the technology to be sufficiently advanced for trials to take place that would, for the first time, harvest cells and produce "meat" that could be used in the production of a 'sausage'. Given the cost of production, this appears to be a demonstration of the viability of the technology rather than a prelude to commercial production in the near future.

Insects and insect protein

31. While insects have not traditionally been used for food in the UK or elsewhere in the European Union, it was estimated by the FAO in 2011 that about 2.5 billion people across the world have diets that routinely include insects. While many insects are regarded as pests that hinder food production, the FAO is interested in promoting edible insects as a highly sustainable source of nutrition.

32. In 2011 the European Commission requested that Member States investigate the use of insects as food in their territories, especially in relation to consumption prior to 15 May 1997. Investigations by the FSA confirmed that a limited number of edible insect species are available in the UK, primarily advertised as 'novelty' foods for curious or adventurous consumers rather than as staple foods.

33. Despite this, the use of purified or partially purified insect protein could have great potential as a food of the future, if a commercial viable source could be identified.

Other potential areas of interest

3D-printing

34. Another area of current interest is 3D printing, which could be used in future to assemble foods by building up layers of different components using various extrusion, deposition and precision cutting techniques. Initially, such products may utilise existing foods and routine food processing techniques. But eventually may involve novel foods and new processes to build a food with a unique 3-D structure.

Committee Action Required

Questions to be explored in this horizon scanning exercise

35. Members may wish to consider the following six questions in framing their discussions:

Based on your expert knowledge, and in the context of the Committee's remit:

1. Can you identify any emerging issues that might present a risk to the public?
2. Based on current evidence, is there anything that needs to be brought to the FSA's attention to help consumers make informed decisions?
3. Are there any risks or opportunities associated with new food technologies or other technologies that might affect the food system?
4. Are there any risks or opportunities arising for consumers as a result of the changing landscape of food production?
5. Are there any risks or opportunities associated with alternative approaches to regulation?
6. Is there anything else relating to emerging issues and technologies that you wish to bring to the FSA's attention?

36. The Committee is asked to:

- consider the questions posed in this paper, in conjunction with Members' own wider knowledge, in relation to the future of the food system and of consumers' interests in relation to food;

- determine the innovations in relation to new foods or food ingredients, or developments in food production, it sees as having an impact on food and the food chain by the year 2025; and
- comment on the implications these impacts may have for the safety, affordability, security and sustainability of the food system.

37. The outputs from this discussion may include a list of issues identified by the Committee, ranked in order of strategic importance for the FSA.

Secretariat

July 2015