Roundtable on Novel Food Regulation 2023

30 Oct, 2 – 5 pm (GMT +8)

Marina Bay Sands Expo & Convention Centre (Melati Ballroom, Level 4)

Executive summary

Introduction

The Singapore Food Agency (SFA) organised the 4th Roundtable on Novel Food Regulations ("Roundtable") on 30 October 2023. The Roundtable is an international platform for regulators, the industry, academics, and key stakeholders in the novel food ecosystem to share best practices and experiences on safety and regulatory aspects of novel foods, as well as to identify opportunities for collaboration. Roundtable 2023 invited participants to discuss strategies by which safety assessments and regulatory approvals can be harmonised and streamlined at an international level.

Proceedings

The Roundtable started with technical presentations from experts representing the cell-cultivated meat and seafood (**CM**), precision fermentation (**PF**) and biomass fermentation / microbial proteins (**BF**) sectors. The presentations provided attendees with an understanding of high-priority challenges on risk assessment and public sharing of information for foods from **CM**, **PF**, and **BF**. After the technical presentations, attendees were split into breakout groups, one each for **CM**, **PF**, and **BF**. The breakout group session involved discussions on how the challenges highlighted during the technical presentations can be addressed. After the breakout group session, attendees convened for a panel discussion.

Key points raised

- Sharing of safety assessment information in the public domain may streamline the regulatory approval process by reducing duplicative safety assessments. However, companies can have reservations on sharing certain proprietary information.
- Industry can contribute towards harmonisation of regulatory approvals through sharing of common inputs and processes, as well as practical experiences. Industry associations can facilitate sharing among companies.
- Allergens, toxins, and anti-nutrients are food safety hazards of concern in **CM**, **PF**, and **BF**. These hazards may be new or at increased levels in novel foods compared to traditionally consumed foods. More work is needed to improve analysis and safety assessments of these hazards.
- It is important that stakeholders work towards internationally harmonised names and labels for food products of **CM, PF**, and **BF**. This would empower consumers to make informed decisions and convey the message that these products have undergone rigorous assessments.

Conclusion

As novel foods are increasingly being introduced into various markets around the world, international standards for these food products would help to ensure food safety while facilitating fair international trade practices. Towards developing international standards, regulators, the industry, and relevant stakeholders should continue to work together on harmonising safety assessment criteria, bolstering scientific data and methods to support safety assessment, as well as labelling.

Full Meeting Report

1 The Singapore Food Agency (SFA) organised the 4th Roundtable on Novel Food Regulations ("Roundtable") on 30 October 2023, 2 – 5 pm, at the Marina Bay Sands Expo and Convention Centre. The Roundtable is an international platform for regulators, the industry, academics, and key stakeholders in the novel food ecosystem to share best practices and experiences on safety and regulatory aspects of novel foods, as well as to identify opportunities for collaboration.

2 There were 296 participants in total, comprising 210 in-person and 86 virtual attendees. Governmental and intergovernmental agencies, the industry, the research community, and advocacy groups were represented at the Roundtable.

3 Continuing from broad agreement at Roundtable 2022 that harmonisation of regulatory approaches, standards, and information sharing would benefit the novel food ecosystem[1], Roundtable 2023 invited participants to discuss the following:

(a) Strategies by which safety assessments and regulatory approvals can be harmonised and streamlined at an international level.

(b) Key elements of an "ideal" safety assessment dossier, challenges associated with these key elements (e.g., data gaps, ambiguity on depth of information required, testing methods), and how these challenges can be addressed.

(c) Strategies for public sharing of information relevant to safety assessments and regulatory aspects (e.g., approvals, conditions of use, labelling).

(d) Specific areas or challenges that can be prioritised for further collaboration between the industry, academia, advocacy groups, the government, and other stakeholder groups.

Technical presentations

4 The Roundtable started with technical presentations from experts representing the cell-cultivated meat and seafood (**CM**), precision fermentation (**PF**) and biomass fermentation / microbial proteins (**BF**) sectors. The presentations provided attendees with an understanding of high-priority challenges on risk assessment and public sharing of information for foods from **CM**, **PF**, and **BF**. Details of the technical presentations can be found in **Annex A**.

Breakout group session

5 After the technical presentations, attendees were split into breakout groups, one each for **CM**, **PF**, and **BF**. The breakout group session involved discussions on how the challenges highlighted during the technical presentations can be addressed by various stakeholders.

6 Prior to the Roundtable, SFA had worked with experts from the **CM**, **PF**, and **BF** sectors to produce a set of discussion questions for each sector. The intent was to foster sharing of

[1] To read the full post-event summary for Roundtable 2022, go to: https://www.sfa.gov.sg/food-information/novel-food, under "Other Resources on Novel Food" click on "Roundtable on Novel Food Regulations 2022".

knowledge and views during the breakout group session. The discussion questions were shared with participants ahead of the Roundtable. The experts involved in each sector and the discussion question sets are found in **Annex B**.

7 Participants engaged in lively discussions during the breakout group session. Participants were able to reach general consensus on certain aspects relating to safety assessment, information transparency, and labelling. These are detailed below.

8 Key discussion points from the **CM** breakout group are summarised:

(a) Participants proposed establishing a database in the public domain with a list of chemical inputs used specifically in CM production with corresponding safety data. Information that can be shared include:
   (i) Purity
   (ii) Toxicological data and assessment
   (iii) Intended use (e.g., as growth factor, nutrient, scaffold)

(b) While participants acknowledged that sharing of information in the public domain may streamline the regulatory approval process, some participants noted that it can be difficult to find a balance between transparency versus protecting proprietary information that can give a company its business advantage.

(c) On assessing substances with unknown toxicological profiles, participants agreed that the Threshold of Toxicological Concern (TTC) approach is sometimes useful. However, participants cautioned on the misuse of TTC for substances that are not applicable, such as proteins and carcinogens.

(d) On scaffolds, participants agreed that it may be useful for the industry to develop a standard list of scaffold ingredients with corresponding safety data. This can reduce duplicative assessments for both the industry and regulators.

(e) On allergens, participants recognised the need to standardise methods (e.g., mass spectrometry or antibody based) for identifying and quantifying allergens in conventionally sourced meat. This will set the basis for risk assessment of allergens in CM. Participants agreed that if there are certain allergens that are overexpressed in a specific CM product compared to its conventional counterpart, it would be the responsibility of the company to assess the food safety risks of the overexpressed allergens.

(f) On terminology, participants agreed that that using a single term would reduce confusion among consumers. Participants acknowledged that “cultivated meat/seafood” is currently the industry’s preferred term. More work from the industry and advocacy groups is required to inform consumers on the benefits associated with choosing “cultivated meat/seafood”.

(g) On indicating processing aids on product labels, participants agreed that if a processing aid is not present in the final product, it would not be necessary to include the processing aid as an ingredient on the product label. This is aligned with current food labelling standards.

(h) As more companies now are looking to launch hybrid products (e.g., CM mixed with plant-derived proteins), some participants opined that it would be useful to have a standard on the minimum amount of CM ingredient in a hybrid product to still call it a product containing CM.

9 Key discussion points from the **PF** breakout group are summarised:

(a) Participants agreed that the inputs and processes in PF are largely standardised, translating to similar risk assessment and management approaches. Industry can contribute towards harmonisation through sharing of practical experiences.

(b) There is still debate on the extent of chemical characterisation needed to show that an ingredient made with PF is chemically identical to the conventional counterpart.

(c) The technology behind PF itself is not that new and has been used to make food additives and enzymes. However, a recent trend is to use PF to make food ingredients, such as whey and egg proteins, which highlights the need to consider the risk assessment of such foods to identify contaminants.

(d) Unexpected contaminants (e.g., mycotoxins, endotoxins) from microbial hosts can introduce food safety risks. Purification may sometimes fail in sufficiently removing these contaminants. Therefore, regulator monitoring of such contaminants in the final product is important.

(e) While proteins made with precision fermentation may have different post-translation modifications (PTM) compared to the conventional counterpart, some participants were of the opinion that this is unlikely to be of safety concern as PTMs are generally degraded by digestion.

(f) There is a currently a limited number of microbial species widely utilised in precision fermentation. These microorganisms have been well characterised and are not known to pose significant health risks. If a company decides to use a microorganism that has not been used in precision fermentation, the company should establish that the host is neither pathogenic nor toxigenic via scientific studies. These studies include, but are not limited to, whole genome analysis and metabolite analysis.

(g) PF ingredients that have received regulatory approvals should have their safety assessment data and intended use in food publicly disclosed. Companies should consider this public disclosure in their intellectual property (IP) strategy to balance transparency with protecting IP assets.

(h) There is currently no international consensus on how ingredients made with PF should be labelled. Participants noted that some consumers have negative sentiments towards foods made with genetically modified organisms (GMO), even though the GMO is removed from the finished food ingredient. Participants noted that companies are using the “non-animal” qualifier for PF ingredients that are

bioidentical to conventional animal products (e.g., “non-animal” milk protein). Participants agreed that it would be helpful for consumers if industry and regulators can agree on consistent terminology.

10 Key discussion points from the **BF** breakout group are summarised:

(a) Though the use of non-traditional substrates (e.g., agricultural side-streams) is gaining traction in BF, there are data gaps on the safety from such use. Industry and academia can conduct collaborative research to fill in the data gaps.

(b) Genome-based bioinformatics screening of a microbial strain should be a recommended tool to conduct initial screening on the potential of the strain to produce toxins or allergens. However, bioinformatics tools to screen for toxins and allergens are emerging and there is no international harmonisation on how to use these tools and how to interpret the data generated (e.g., no concrete cut-off value for false-positives / false-negatives)

(c) Bioinformatic screening by itself is not sufficient to determine if a microbial strain produces toxins and/or allergens. Targeted metabolite and protein analysis should also be done to bolster the comprehensiveness of risk assessments. In addition, toxins and allergens may be differently expressed between the fruiting body and mycelium. Therefore, metabolite and protein analysis should be targeted depending on which part is used.

(d) Even if a microbial strain naturally produces toxins or allergens, participants noted that genetic engineering or laboratory-based adaptation could be used to create microbial strains that do not produce toxins or allergens.

(e) Participants noted that animal studies are currently the "gold standard" to support safety assessment of microbial proteins due to established methodologies and existing reference sets. Nonetheless, participants noted that there is strong interest and research activity in various countries/regions to develop new approach methodologies (NAMs) that can reduce and/or replace the use of animal studies. Some participants highlighted that there is potential for NAMs to better predict mammalian digestion fates and metabolic changes in humans compared to animal models.

(f) Some companies may be using proprietary strains and may be reluctant to publicly release full information (e.g., whole genome sequence) on their strains. For such a scenario, participants proposed that companies can still release food safety information based on a publicly available reference strain that is phylogenetically close to the proprietary strain. Companies should still make available information demonstrating that they have analysed toxins and allergens that may be associated with the reference strain.

(g) Participants agreed that protein quality / nutritional equivalence should be a consideration in safety assessment if a microbial protein product is intended to replace meat. There is a need for the industry, standards setting bodies, and

regulators to harmonise methods for measuring protein quality. The protein quality of a microbial protein product should be indicated on the label.

(h) Some participants felt that purine removal should not be mandatory as certain conventionally consumed foods also have high levels of purines (e.g., meat and seafood). As an alternative, companies should be able to make "low-purine" claims on product labels if they have taken steps to do so.

(i) Participants agreed that microbial protein products should be labelled with the scientific and/or common name of the microorganism that made it. It can be indicated in parentheses, for example "Mycoprotein (from *Fusarium venenatum*)".

Panel discussion

11 After the breakout group session, attendees convened for a panel discussion moderated by Dr Tan Lee Kim (Director-General, Food Administration & Deputy CEO, SFA). The panellists were representatives from governmental and intergovernmental agencies along with the main facilitators from **CM**, **PF**, and **BF**:

Panellist	**Affiliation**
Masami Takeuchi (Ph.D.)	Food and Agriculture Organization of The United Nations (FAO)
Eunju Lee (Ph.D.)	Korea Ministry of Food and Drug Safety (MFDS)
Rick Mumford (Ph.D.)	UK Food Standards Agency (UK FSA)
Michelle Catlin (Ph.D.)	US Department of Agriculture's Food Safety and Inspection Service (USDA-FSIS)
Jo Anne Shatkin (Ph.D.)	Vireo Advisors, LLC
Vince Sewalt (Ph.D.)	International Flavors & Fragrances (IFF)
William Chen (Ph.D.)	Nanyang Technological University (NTU)

12 Key points raised by the panellists and attendees were:

(a) Allergens, toxins, and anti-nutrients are common concerns in foods made using **CM**, **PF**, and **BF**. These food safety hazards may be new to foods or may already been identified in conventionally consumed foods but occur at unexpected levels in novel foods. There are research gaps in identifying the hazards as well as calculating the dietary exposure to these hazards. Participants therefore saw the need for further research collaboration between the industry, research community, regulatory agencies, and other stakeholders to support food risk assessment. These collaborative efforts can include developing and standardising analytical methods for quantifying hazards.

(b) Regulatory agencies are generally open to publicly share completed safety assessments of approved novel foods in the spirit of transparency and building trust. Participants agreed that such a move would also streamline regulatory approvals across countries/regions by reducing duplicative risk assessments. However, regulators would need to reach consensus with the industry on what information can be shared and what should be kept confidential.

(c) Industry associations can contribute towards streamlining regulatory approvals by collating and publicly sharing a common list of inputs and processes within each novel food sector. This would empower regulators to work with other relevant stakeholders to co-develop internationally harmonised standards, guidelines, and recommendations on food safety aspects of these inputs and processes.

(d) Making completed safety assessments publicly available would help consumers better appreciate the level of scientific rigour and scrutiny behind these assessments. This can build consumer trust in novel foods.

(e) As novel foods are increasingly being introduced into various markets around the world, having relevant Codex standards would facilitate fair international trade practices while ensuring food safety for consumers. This would also help bring along less developed countries which may be interested in novel foods (e.g., R&D, local production, import) but do not have the capacity to develop regulatory mechanisms for novel foods by themselves.

(f) Food safety risks from new allergens in novel foods can be managed by allergen labelling. This protects a small subset of vulnerable consumers while providing more food choices for most other consumers.

(g) The use of food processing and agricultural side-streams as nutrient sources is gaining traction in novel food production, especially in **PF** and **BF**. There is a need to assess and manage food safety risks arising from using these side-streams. Food safety management measures can include heat treatment of the side-streams to inactivate microorganisms and regular monitoring of chemical hazards.

(h) There was a general consensus that both regulators and the industry should work together to standardise terminology to provide clarity for consumers. For example, the common or scientific names of microorganisms used in **PF** and **BF** should be indicated on the label.

(i) In developing internationally standardised terminology it is important to consider the perceptions of different countries/regions and cultures. More research and stakeholder discussions are needed in this regard.

Acknowledgement

13 SFA thanks all discussion facilitators, panellists, and participants for sharing their valuable insights and experiences at this Roundtable. SFA looks forward to continued support from stakeholders for next year's Roundtable. SFA also acknowledges Temasek Holdings' support in organizing this Roundtable in conjunction with the Singapore International Agri-Food Week (SIAW) 2023 from 30 October – 2 November 2023. SFA will continue to engage with interested parties and stakeholders to develop standards, guidelines, and recommendations that ensure the safety of novel foods while facilitating fair trade and business practices.

Photos

Opening address by Dr Tan Lee Kim

Roundtable 2023 attendees

Technical presentation on safety assessment of cell-cultivated meat and seafood by Dr Jo Anne Shatkin

Technical presentation on safety assessment of food ingredients made with precision fermentation by Dr Vince Sewalt

Technical presentation on safety assessment of food ingredients made with biomass fermentation by Dr Vince Sewalt

Breakout group session

Panel discussion. From left: Dr Tan Lee Kim, Dr Jo Anne Shatkin, Prof. Rick Mumford, Dr Michelle Catlin, Prof. William Chen, Dr Masami Takeuchi, Dr Vince Sewalt, Dr Eunju Lee

Breakout group facilitators with Dr Tan Lee Kim. From left: Dr Bianca Curzio, Dr Karin Ke, Ms. Shashiprabha Sooriarachchi, Dr Vince Sewalt, Dr Michelle Catlin, Dr Tan Lee Kim, Prof. Rick Mumford, Dr. Jo Anne Shatkin, Prof. William Chen, Dr. Masami Takeuchi, Dr Eunju Lee, Dr Liz Specht, Dr Dean Powell, Mr Peter Yu

Annex A – List of technical presentations with corresponding presenters

Presentation title	Presenter
Risk assessment of cell-cultivated meat and seafood	Jo Anne Shatkin (Ph.D.) President Vireo Advisors, LLC
Risk assessment of food ingredients made using precision fermentation	Vince Sewalt (Ph.D.) Head of Scientific & Public Affairs, IFF Global Regulatory Affairs International Flavors & Fragrances
Risk assessment of food ingredients made using biomass fermentation	William Chen (Ph.D.) Michael Fam Endowed Chair Professor in Food Science and Technology Nanyang Technological University

Annex B – Experts facilitating the breakout group session and discussion questions

Sector	Expert	Affiliation	Contributing as:
Cell-cultivated meat and seafood (**CM**)	Jo Anne Shatkin (Ph.D.)	Vireo Advisors, LLC	Main facilitator
	Dean Powell (Ph.D.)	The Good Food Institute APAC (GFI-APAC)	Co-facilitator
	Hannah Lester (Ph.D.)	Atova Regulatory Consulting; Cellular Agriculture Europe (CAE); Gourmey	
	Peter Yu (BMA, LLM, M.Sc.)	APAC Society for Cellular Agriculture (APAC-SCA)	
Precision fermentation (**PF**)	Vince Sewalt (Ph.D.)	International Flavors & Fragrances (IFF)	Main facilitator
	Karin Ke (Ph.D., DABT, ERT)	Keller and Heckman LLP	Co-facilitator
	Shashiprabha Sooriarachchi	Nestlé	
Biomass fermentation / microbial proteins (**BF**)	William Chen (Ph.D.)	Nanyang Technological University (NTU)	Main facilitator
	Liz Specht (Ph.D.)	The Good Food Institute (GFI)	Co-facilitator
	Bianca Curzio (Ph.D.)	Nourish Ingredients	Co-facilitator

CELL-CULTIVATED / CULTURED MEAT AND SEAFOOD (CM)

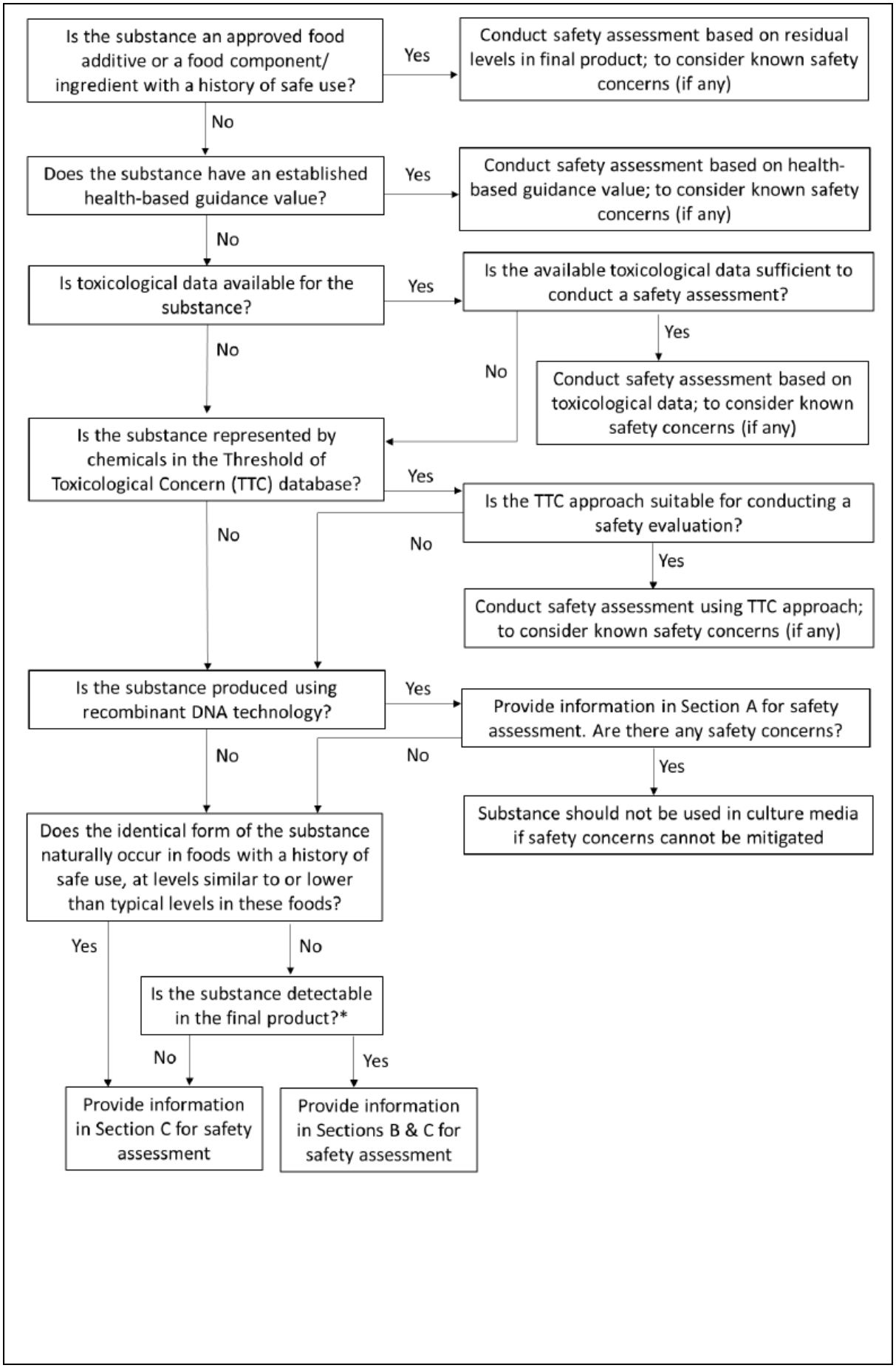
1. Chemical components – Jo Anne Shatkin, Ph.D., Vireo Advisors, LLC

a. How can we assess the safety of ingredients with a lack of history in food?
    i. One class of these is drug-like (*i.e.*, pharmacologically active) molecules that are used in CM proliferation? See: Flow chart from SFA below

b. Is the Toxicological Threshold of Concern (TTC) sufficient for chemicals with no known toxicological data?

c. How to define the grade / purity of the inputs for novel ingredients?

d. Inputs – what information goes in the public domain?
    i. Certain classes of additives? (e.g., allergens, hormonally active)
        - Antibiotics
        - Sterilization substances
        - Cryogenic compounds
        - Culture media components
        - GM ingredient safety
    ii. Purity information
    iii. Impurities and byproducts
    iv. Contaminant safety assessment approach


Is the substance an approved food additive or a food component/ ingredient with a history of safe use?
Yes
Conduct safety assessment based on residual levels in final product; to consider known safety concerns (if any)
No
Does the substance have an established health-based guidance value?
Yes
Conduct safety assessment based on health-based guidance value; to consider known safety concerns (if any)
No
Is toxicological data available for the substance?
Yes
Is the available toxicological data sufficient to conduct a safety assessment?
Yes
Conduct safety assessment based on toxicological data; to consider known safety concerns (if any)
No
No
Is the substance represented by chemicals in the Threshold of Toxicological Concern (TTC) database?
Yes
Is the TTC approach suitable for conducting a safety evaluation?
Yes
Conduct safety assessment using TTC approach; to consider known safety concerns (if any)
No
No
Is the substance produced using recombinant DNA technology?
Yes
Provide information in Section A for safety assessment. Are there any safety concerns?
Yes
Substance should not be used in culture media if safety concerns cannot be mitigated
No
No
Does the identical form of the substance naturally occur in foods with a history of safe use, at levels similar to or lower than typical levels in these foods?
Yes
No
Is the substance detectable in the final product?*
No
Yes
Provide information in Section C for safety assessment
Provide information in Sections B & C for safety assessment

2. Production process Dean Powell, Ph.D., The Good Food Institute APAC

a. What are the potential food safety hazards arising from media recycling? How do we assess and manage these hazards?

b. Approaches for assessing cell safety and stability: What are the regulatory safety outcomes of assessing cell line stability and what data requirements are appropriate to demonstrate this?
    i. What food safety risk does cell line genetic variability pose (except for allergen profiles)?
    ii. What type of analysis, if any, is appropriate to rule of these food safety risks (genome sequencing, -omics, karyotyping, phenotypic stability)? Does a maximum continuous culture point need to be demonstrated, and if so, why?

c. How can Hazard Analysis and Critical Control Point (HACCP) principles be applied and adjusted to cultivated meat production, packaging, storage and cooking requirements?
    i. What novel CCPs exist for cultivated meat and how can standardized controls be developed?

d. What food safety hazard and cell line stability information belongs in the public domain?

3. Health and nutrition – Hannah Lester, Ph.D. Gourmey, Cellular Agriculture Europe and Atova Regulatory Consulting

a. Scaffolds and safety
    i. Should scaffolds be approved as food ingredients by themselves or as part of a cultivated product application?
    ii. How do we address the safety of scaffolding?
    iii. What data are needed to support the safety of scaffolding?
        - Considerations of the nutrient profile
        - Presence of antinutrients if plant-based
        - Presence of small particles and nanomaterials

b. How should we go about carrying out a safety assessment of allergens that may be present CM?
    i. Proteomics
        - How do we address overexpression of certain allergens not present or present at a lower level in conventional meat?
        - How useful is such an analysis and how do we interpret the data?
    ii. Bioinformatics and sequence homology with known allergens
    iii. Digestibility studies & characterization of undigested proteins
    iv. ELISAs – useful tool for confirming presence of known allergens? What are the limitations?
    v. How to deal with other sources of potential allergens from the production process?

vi. What does a tiered approach look like?

c. Comparing the nutritional profile of cultivated products to conventional counterparts:
   i. Should nutritional equivalence to conventional products be a regulatory consideration / requirement?
   ii. What if there are differences? How similar should they be to claim equivalence? Does it matter?
   iii. How do we show that cultivated products are not nutritionally disadvantageous?
   iv. What methods should be used and are current methods appropriate for cultivated products?

d. What belongs in the public domain?

4. Terminology / labeling – Peter Yu, MBA, LLM, MSc. APAC Society for Cellular Agriculture

a. **Terminology**: 'Cultivated' Meat – as a prefix to describe is conventionally utilized across the world along with other terms including lab-grown, cultured, cell-cultured and so forth.
   i. What is your consensus on the potentiality, or in other words are we ready to converge on a single term or what are your comments?
   ii. What would it take to reach a global consensus on the food, or is it even needed?
   iii. What are some current thought or challenges that your specific government may be facing in the terminology area
   iv. What belongs in an ideal dossier? Any other comments?

b. **Labeling**: How you label the product is important especially in regard to consumer transparency, especially when it comes to novel products within the framework of cell ag. Along with terminology, labeling is something that is separately being developed concurrently as standards in Singapore.
   i. Other than stating the ingredients utilised in the production process, what else should be required for labelling practices? E.g. should a company be required to specify, media component (processing aids) that are normally found in the final - finished product
   ii. What are you thoughts on introducing a 'logo' for Cell Ag products
   iii. SFA is indistinguishable for any quantity of CM products to be called CM products - should there be a minimum percentage in hybrid products that must be met for cultivated foods?
   iv. What belongs in an ideal dossier? Any other comments?

c. **Public perception / consumer / tasting framework additional points to consider**: In order to drive the industry forward – it is important for the consumers to be immersed with an understanding of the product and have the ability to taste it.

i. Please provide feedback or comments on the current work by various of governmental or industry bodies to promote the industry as a whole - what can be done better?
ii. How do we facilitate better tasting regulatory frameworks, that allow companies test their products among the consumers? What are some of the challenges that your specific company are facing in this regard? What is done well?
iii. List key concerns that you believe are faced by consumer perceptions that are not currently addressed efficiently
iv. What belongs in an ideal dossier? Any other comments?

d. **What belongs in the public domain?** Information pertaining to safety may be proprietary to the company, and sensitive to which it shall not be released in public.
   i. What kind of information on a dossier do you believe constitute 'fair' to be released on a public scale? Or, what kind of information should be restricted?
   ii. How do we best facilitate the interaction between government entity and company to ensure trust of the handling of the information?
   iii. Please share any practices encountered from your jurisdiction
   iv. Any other comments?

FOOD INGREDIENTS FROM PRECISION FERMENTATION (PF)

1. Allergenicity assessment and toxicology considerations – Karin Ke (Ph.D., DABT, ERT), Keller and Heckman LLP

a. Allergenicity assessment
   i. What are the possible allergenic sources (proteins themselves, proteins/peptides from the production organisms, allergens used in fermentation, anywhere else)?
   ii. How to assess allergenicity (literature, bioinformatics, in vitro tests)?
   iii. Would the worst-case exposure calculations be adequate vs. thresholds/RfDs (ED_{01}, ED_{05})?
   iv. Would final product testing be adequate to rule out allergenicity, or vs. thresholds/RfDs?

b. Toxicological studies & Exposure
   i. What could be "toxic" [proteins themselves, proteins/peptides from the production strain, inputs used during the manufacturing process (i.e., fermentation), impurities, anything else]?
   ii. To test or not to test? Which studies are essential (genotox, oral tox) and why? Alternatives?
   iii. What are the intended uses and use levels? What is the estimated daily intake (EDI)?
   iv. What is an acceptable Margin of Safety (MOS) for macro-ingredients?

2. Prerequisites for accepting substitute safety data – Vince Sewalt (Ph.D.), International Flavors & Fragrances

a. **Ingredient**: how do you demonstrate substantial equivalence?

b. **Production strain**: What are differences between EFSA's Qualified Presumption of Safety (QPS) and Safe Strain Lineage?
   i. A Safe Strain Lineage can be established when enzyme preparations from at least two members of a strain lineage have been evaluated to be non-toxigenic and non-pathogenic.

c. How do you accommodate for exposure to microbial metabolites, especially for macro-ingredients?

3. Transparency and labelling – Shashi Sooriarachchi, Nestlé

a. **Dossier**
    i. What is the desired level of transparency of the dossier after the evaluation by food safety agencies?
    ii. What is the level of information required in the No-Questions Letter or Summary Opinion to be shared by food safety agencies?

b. **Labelling**
    i. What is the appropriate name of the ingredient, and what considerations are important?
        - Example: vs beta-lactoglobulin vs whey protein vs milk protein vs milk
        - Should production organism be mentioned as part of the ingredient listing?

4. Gathering questions

a. What are some of the common risk assessment concepts across the 3 types of novel food (cultivated meat, precision fermentation, and fungal biomass)?

b. What are some of the key differences in risk assessment for these 3 types of novel food?

FOOD INGREDIENTS FROM BIOMASS FERMENTATION / MICROBIAL PROTEINS (BF)

1. Input and processes – Professor William Chen (Ph.D.), Nanyang Technological University

a. Food processing side-streams are touted as a promising substrate to produce microbial proteins. However, the use of food processing side-streams also introduces food safety concerns in the product. What are some guidelines / best practices to ensuring the safety of food processing side-streams as substrate?

b. How can existing HACCP principles be applied and adjusted to biomass fermentation so as to ensure the safety of the product?

c. What are some inputs and processing aids used in biomass fermentation that do not have a history of use in food manufacturing / processing? How should we assess the safety of these inputs and processing aids?

2. Toxin and allergens – Liz Specht (Ph.D.), The Good Food Institute

a. Are bioinformatics approaches sufficient and fit-for-purpose in assessing the allergenic and toxicological potential of new types of microbial proteins?

b. How should we go about carrying safety assessment of potential new allergens?

c. Are animal studies necessary to prove the safety of new types of microbial protein?

3. Nutrition and labelling – Bianca Curzio, Nourish Ingredients

a. Microbial proteins are often intended to be used as meat replacement. In view of that, should the amino acid composition / protein quality / PDCAAS / DIAAS be a consideration?

b. Microbial proteins often contain elevated purine levels from high levels of RNA inherent to microorganisms. While purines are not necessarily a food safety hazard for most consumers, they can be problematic for people who suffer from gout. Therefore, should RNA/purine removal be a necessary step for all microbial proteins? At what level would RNA/purine constitute a significant food safety risk for sensitive individuals?

c. How should we approach labelling a microbial protein product for consumers that provides transparency while protecting confidential business information? E.g., scientific name, proprietary name, common name?