Welcome & Introduction

Sterling Crew Hon. FIFST

President
IFST
Welcome & Introduction

Barbara Bray  MBE, FIFST
Spring Conference Chair
2023
Important Announcements

1. There are no fire alarm drills planned during the SC23 event. Should a certain case arise, please listen to the PA announcement and follow instructions.

2. The hospitality lounge next to the atrium is available as a quiet space or to meet fellow delegates.
SC23 Themes

- Food Security
- Health & Nutrition
- The Environment
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POLL #1

https://app.sli.do

#4271 758
Share Your Experience Using The #IFSTSC23 and Tag Us!

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IFST SPRING CONFERENCE 2023
TAMING THE PERFECT STORM
THE POWER OF FOOD SCIENCE AND TECHNOLOGY

27 APRIL 2023
CARDIFF METROPOLITAN UNIVERSITY
IFST SC23
Keynote Speaker

Julie Hesketh-Laird

Deputy Chief Executive
Food Standards Scotland
Food Security, Dietary Health and the Environment: How Scotland is tackling the challenges

Julie Hesketh-Laird
Deputy Chief Executive, Food Standards Scotland

IFST SPRING CONFERENCE
27 April 2023
FSS in a nutshell

Established 1 April 2015 under the Food (Scotland) Act 2015 as the new public sector food body for Scotland

Independent of Ministers & industry. Accountable to the Scottish Parliament

We provide advice that is impartial and evidence based

Three objectives under The Food (Scotland) Act:

To protect the public from risks to health arising in connection with the consumption of food

Improve the extent to the public have diets conducive to good health

Protect other interests of consumers in relation to food

To protect the public from risks to health arising in connection with the consumption of food

Improve the extent to the public have diets conducive to good health

Protect other interests of consumers in relation to food
Levels of concern about food prices and food supply shortages have significantly grown since tracking began in 2015.
Inflation - what is the data telling us?

Annual inflation rate for food and non-alcoholic beverages highest for over 45 years
Office of National Statistics

Food inflation rate is at its highest since 1977
Office of National Statistics

Between 1 in 4 and 1 in 5 have cut back on essentials such as food in early 2023
Scottish Government

9.3 million adults experienced food insecurity in Jan ‘23 with poorest being most impacted
Food Foundation

In the last 6 months 56% of those surveyed were eating out less often to save money
Food Standards Scotland

50% of consumers in Scotland have admitted to eating food passed its use by date to save money
Food Standards Scotland
The Global Challenge

- Interplay between food production and consumption, environment and health
- Systems level approach needed to understand the trade offs and identify solutions that will have the greatest benefit
1. Food Security
Food Security:

Food Imports

Nearly half of what we eat comes into the UK from abroad, and two-thirds of that has in recent years come from the EU.

The lack of full import controls on EU goods reduces our ability to prevent foods that do not meet the UK’s high standards being placed on our market.
Scottish Government Food Security and Supply Taskforce

• Set up in March 2022, jointly with industry, to monitor, identify and respond to any potential disruption to food security and supply resulting from the impact of Russia’s invasion of Ukraine.

• Chaired by Cabinet Secretary of Rural Affairs and CEO of Scotland Food and Drink.

• Recommended short, medium and longer-term actions to mitigate impacts, resolve supply issues and strengthen food security and supply in Scotland.
2. Dietary Health
Dietary Health: A Scottish Perspective

In Scotland:
- More than two thirds of adults live with overweight or obesity
- Average consumption of fruit, vegetables & oily fish significantly below dietary goals
- Growing concerns around food prices & cost of living and the impact on health inequalities
- Very little shift over the last 20 years
Dietary Health:  
**UK Government Food Strategy**

**Objectives:**

- To deliver a prosperous agri-food and seafood sector that ensures a secure food supply in an unpredictable world and contributes to the levelling up agenda through good quality jobs around the country.

- To deliver a sustainable, nature positive, affordable food system that provides choice and access to high quality products that support healthier and homegrown diets for all.

- To deliver export opportunities and consumer choice through imports, without compromising our regulatory standards for food, whether produced domestically or imported.
Dietary Health: Scotland’s Good Food Nation Act

“a Good Food Nation, where people from every walk of life take pride and pleasure in, and benefit from, the food they produce, buy, cook, serve, and eat each day.”

- Places duties on Scottish Ministers and certain public authorities to produce plans for delivering outcomes which support Scotland’s social and economic wellbeing, the environment, people’s health and economic development.

- A Human Rights Bill giving effect to international human rights law in Scots law, including a right to adequate food, as part of the overall right to an adequate standard of living.

- The establishment of a Food Commission to review progress and support ministers and public authorities in achieving the desired outcomes.
Dietary Health:
FSS Public Health Nutrition Strategy

VISION: A healthier and more sustainable food environment

Drive change through legislative and voluntary measures

Science and evidence
FSS nutrition monitoring and evidence

Expertise
Leading authority on public health nutrition

Collaboration
Partnership working

Influence
Rebalance the food environment

UNDERPINNED BY: Public health nutrition monitoring and evidence

Reducing health inequalities
3. The environment
The environment:
FSS Consumer Tracker data

The impact of food production and packaging on the environment continues to be in the ‘Top 10 areas of concern’ for people in Scotland.

Sustainable production and packaging of food is an important issue for consumers, but less than half (44%) feel they have clear information about this.

Consumer preferences do not reflect what Scotland produces (much of which is exported), healthy eating guidelines or net zero aims.

Three-quarters of consumers say they always actively try to reduce food waste, but recognise more needs to be done.
The Environment: FSS contributions

- FSS Sustainability strategy
- Active promotion of the Eatwell Guide
- Eat Well, Your Way online tool
- Supporting partner campaigns
Keeping Pace as a Regulator
Emerging food systems and products

- Novel breeding technologies
- New farming systems
- Alternative proteins
- Methane reducing feed
- Non plastic packaging

- Risk Assessment
- Market Authorisation
- Food Safety Management
- Method Development
- Consumer interests
In summary
A combined effort
**KEY CHALLENGES**

**Public Sector Resourcing**
- Lack of a sustainable supply of qualified Environmental Health and Food Safety Officers: ageing workforce, reduction in new entrants to the profession.
- Increased pressure on Local Authorities following EU Exit and COVID.
- Need for modernisation to align with changing priorities.

**Science, Technology and Data**
- Developing and maintaining an appropriate breadth of scientific expertise and laboratory capacity.
- Exploiting digital solutions – Apps, AI, blockchain.
- Improving data sharing and systems for managing and analysing big data.

**Changing Population**
- Risk factors and vulnerability to dietary and foodborne related diseases.
- Understanding attitudes and behaviours.
- Reaching consumers and influencing improvements to diet.
Thank you
Theme 1:
Food Security and The Environment
Transforming Food System Outcomes: Who Needs To Do What?

Dr John Ingram

Food System Transformation Programme Leader ECI
University of Oxford
Transforming Food System Outcomes

Who needs to do what?

John Ingram

Food Systems Transformation Programme Leader
Environmental Change Institute, University of Oxford
Our starting point: What do we want from Food Systems?

- Food Security
- Other Societal Interests
  - Health
  - Income
  - Profit
  - Rural development
  - Employment
  - Environment
  - Landscape
  - Ecosystem services
  - Animal welfare
  - …
We know the overall UK food (in)security ‘situation’

67 million

- Insufficient cals
  - Insufficient nutrs
    - ~ 4-8 million
- Excess cals (incl. many with insufficient nutrs)
  - ~ 28 million
- Insufficient nutrs
  - ? 30 million
- Sufficient cals
  - Sufficient nutrs
    - ? < 50 %

- Malnutrition: Triple aspects of food insecurity the “new normal”.
- UK-wide NHS costs attributable to overweight and obesity are projected to reach £9.7 billion by 2050.
- Wider costs to society estimated to reach £50 billion per year by 2050
Aim for ‘sufficient’

Food security

... exists when all people, at all times, have physical, economic and social access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

“enough for a particular purpose; as much as you need”
... OED
But we know that many are challenged by the ‘cost of living’ crisis.
What determines which circle we fall into?

**CONSUMERS**

- Constraints on dietary choice and diversity
  - affordability, preference, allocation, cooking skill, convenience, cultural norms, ...
  - \( \Rightarrow \) Consumption by Sub-populations

**FOOD CHAIN ACTORS**

- ‘Post-farm gate’ Food System Activities
  - processing, packaging, trading, shipping, storing, advertising, retailing, ...
  - \( \Rightarrow \) Final Cals/Nutrient Quantity and Price at shop

**PRODUCERS**

- Local, Regional & Global Production Activities
  - farming, horticulture, livestock raising, aquaculture, fishing, ...
  - \( \Rightarrow \) Basic Cals/Nutrient Quantity and Price at farm

Productivity

Diversity & Quality

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Social, Political, Business, S&T and Biophysical Environments

- Insufficient cals
- Insufficient nutrs
- Sufficient cals
- Insufficient nutrs
- Excess cals (incl. many with insufficient nutrs)
- Sufficient cals

Strength of the ‘food environment’
“Unpacking the Food System”

1: Recognising material change and value addition

Social, Economic, Political and Biophysical ‘Environments’
“Unpacking the Food System concept”
2: Identifying the range of Food System ‘Actors’

Noting they are all influenced by a range of ‘drivers’ (policy, economic, social, env, S&T, …)

.... and all have a range of motives
“Unpacking the Food System”

3: Clarifying food security ‘Outcomes’

“... when all people, at all times, have physical, economic and social access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life.”

Food Security, i.e. stability over time for:

- **Food Utilisation**
  - Nutritional Value
  - Social Value
  - Food Safety

- **Food Access**
  - Affordability
  - Allocation
  - Preference

- **Food Availability**
  - Production
  - Distribution
  - Exchange
“Unpacking the Food System”

4: Recognising a range of other ‘Outcomes’

Food Security, i.e. stability over time for:

- **FOOD UTILISATION**
  - Nutritional Value
  - Social Value
  - Food Safety

- **FOOD ACCESS**
  - Affordability
  - Allocation
  - Preference

- **FOOD AVAILABILITY**
  - Production
  - Distribution
  - Exchange

**Socioeconomic Outcomes**

- Health
- Employment
- Profit
- Social capital
- Political capital
- Human capital
- Equity
- ...

“Unpacking the Food System”

4: Recognising a range of other ‘Outcomes’
Mapping the UK Food System report

www.foodsecurity.ac.uk/uk-food-mapping

✓ Number of people employed in the UK food system

✓ Number of enterprises in the UK food system

✓ Economic summary of the UK food system

“Unpacking the Food System”

4: Recognising a range of other ‘Outcomes’

Food Security, i.e. stability over time for:

**Food Utilisation**
- Nutritional Value
- Social Value
- Food Safety

**Food Access**
- Affordability
- Allocation
- Preference

**Food Availability**
- Production
- Distribution
- Exchange

**Socioeconomic Outcomes**
- Health
- Employment
- Profit
- Social capital
- Political capital
- Human capital
- Equity
- ...

**Environmental Outcomes**
- Climate change
- Water availability
- Water quality
- Biodiversity
- Biogeochemistry
- Soil degradation
- ...

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We know the current state of the food-related UK environment ...

- Soil risks Compaction (4 MHa); Erosion (2 MHa)
- Fresh water >50% England water companies “Areas of serious water stress”
- Biodiversity 41% spp declined since 1970
- Marine resources 70% key populations over-fished

And pollution: chemicals, plastics, litter, …
Increasing risk of disease emergence with the rapid changes at the A-H interface.

Links between human and animal prophylaxis, e.g. AMR
... and a host of ethical and moral issues.

- Inter-generational environmental legacy
- Animal welfare
- Workers rights
- Food waste
- Farmer welfare and safety
- Equity
- Civil harmony
- ...

... and a host of ethical and moral issues.
“Unpacking the Food System concept”
5: Including a range of ‘Outcomes’

‘Activities’ and ‘Outcomes’: Balancing the ‘What We Want’ with the ‘What We Do’ and the ‘What We Get’

**Socioeconomic Outcomes**
- Employment
- Profit
- Social capital
- Political capital
- Human capital
- Equity
- ...

**Environmental Outcomes**
- Climate change
- Water availability
- Water quality
- Biodiversity
- Biogeochemistry
- Soil degradation
- ...

Trade-offs! Synergies!
"Unpacking the Food System concept"

6: Recognising feedbacks (+ve and –ve!)
Sustainable Diets
Aim for **healthy diets from sustainable food systems**

**Healthy Diet Outcomes**
- Calorie and nutrient density
- Quality
- Diversity
- Safe
- Affordable
- Acceptable
- Sufficient

**Sustainable Food System Activities**
- Environmentally sound
- Socially acceptable
- Economically/Enterprise viable

Needs a Great Food Transformation
An unprecedented range of actions taken by all food system sectors across all levels that aim to normalise healthy diets from sustainable food systems.

January 2019
Food System OUTCOMES

Food System Activities (Functioning)

or

Food System Outcomes (Function)

Social Welfare
- Health
- Employment
- Health
- Social capital
- Political capital
- Ethics
- ...

Food Security
- Food Utilisation
- Food Access
- Food Availability

Environment
- Climate change
- Water availability
- Water quality
- Biodiversity
- Biogeochemistry
- Soil degradation
- ...

Food System OUTCOMES
The call for ‘Food System Transformation’

“Providing a healthy, affordable, and environmentally-friendly diet for all people will require a radical transformation of the system. InterAcademy Partnership: Nov 2018

But what does ‘transformation of the system’ actually mean?

What are we actually trying to transform?

Ans: Food System ‘outcomes’ from state A to state B:

⇒ Poor diets to more balanced diets
⇒ Good food safety to even better food safety
⇒ Poor working conditions to fairer conditions
⇒ Poor environmental outcomes to better outcomes
⇒ Current incidence of food crime to reduced level
⇒ Poor animal welfare to better welfare
⇒ …
Reorienting our ‘views’ on Food System Outcomes

The need to ‘shift mindsets’

“The urgency of food system transformation is now irrefutable”

“To the Editor — Poor diets are the main contributor to the global burden of disease, accounting for 20% of premature disease-mediated mortality worldwide. Approximately 3 billion people cannot afford a healthy diet, and more than 3 billion people suffer one or more manifestations of poor nutrition. Poor nutrition can lead to reduced earning potential and increased costs for healthcare, it locks individuals and families into inter-generational cycles of poverty and deprivation, and perpetuates inequality and disadvantage. Even without projected global population growth – predicting a global population of 6.7 billion by 2050 – it is likely that food systems are already operating beyond some planetary boundaries”. Agriculture and its associated land-use changes are the biggest contributors to climate change, accounting for roughly 25% of

“achieving transformation will require a major shift in mindsets — especially regarding possible futures versus the status quo...” Webb et al, Nature Food, 2020

= Shifting our expectations from what we are currently getting (less good) to what we want to get (more good)
1. Agree what Outcomes are acceptable/sought [shift in mind set]  
   (for who, from who’s perspective, by when...)

2. Adapt the Activities to transform the Outcome(s) from State A  
   (current) to State B (future)  
   (who, how, ...)

Degree of transformation sought in food system Outcomes  
determines the degree of adaptation required in food system  
Activities

But needs negotiation (winners and losers)
So who has to do what to Transform Food System Outcomes?

Food System Activities

Signals
Opportunities or Threats

Food System Policies

Social, Economic, Political, Science & Technology and Biophysical Contexts

Food System Outcomes

Socioeconomic Outcomes
Food Security Outcomes
Environmental Outcomes

Ingram and Thornton, Nature Food 2022
Q&A
Break
A Vision of the Food System
2045 CE: Smart People, Smart Processes, Smart Factories

Dr Wayne Martindale

Associate Professor
NCFM - University of Lincoln
A Vision of the Food System, 2045 CE-
Smart People, Smart Processes, Smart Factories

Dr Wayne Martindale, Ph.D FIFST
Food Insights and Sustainability

27th April 2023
Our Research Goal - we seek a more sustainable global food system that provides security, safety and assurance for 9 Billion consumers.

Our approach - enable interdisciplinary transformation with food system data to develop manufacturing tools. These are utilised by manufacturers to deliver productive, efficient, sustainable and healthy future foods. They identify innovative product development and process technology strategies for food and beverage manufacturers - meeting UN Sustainable Development Goals and Science Based Targets in commercial practice.

S3 – Lincoln NCFM Team:

Dr Wayne Martindale – Principal Investigator
Associate Professor Janet Bellamy – Co-Investigator.
Professor Mark Swainson – Co-Investigator.
Emma Vincent – Research Projects Manager.

Websites and further information,
S3 Project, https://www.s3project.net/
Food Insights & Sustainability, https://fis19.blogs.lincoln.ac.uk/
NCFM Research https://www.lincoln.ac.uk/holbeach/research/
Q1. What do we know about our food system?

Global sourcing
Q2. Why is the UK food system not secure for 70 million?

Climate change - risks move around, scale is crucial
<750 Calories/capita/day - 40%, 33 wasted diets/capita/day in HI nations; 4 wasted diets/capita/day in LMI nations

Martindale W (2021) Our connected future with the turn-key technologies that are reducing food waste and improving nutrition. New Zealand Science Review Vol 77
Health and future lifestyles - the most chaotic issue

- Top rank proteins
- Quality and markets
- Prisoners of geography or seasonality


Q3. What we are doing to improve our food system?

Structure and ecosystem

11600 manufacturers

Accessibility, affordability, assurance

Manufacturing is turn-key

Smarter supply chains- can we really not do this?

Vegetation Health Index

- UK
- England
- UK production (relative/normalised)

Dr Wayne Martindale 01/2023
There is a need to re-think the system

Food-resource futures

*Dynamic, real-time simulation of futures, beyond crisis thinking into strategic thinking*

- ‘System change’, ‘resilience’, ‘regionalization’
- Net carbon zero targets, SDG 12
- Production
- Consumption

Codesign of Food System and Circular Economy Approaches for the Development of Livestock Feeds from Insect Larvae Jagtap et al., Foods 2022
https://doi.org/10.3390/foods10081701

Dr Wayne Martindale 01/2023
The demonstration of the now and the future—what we are doing

- P1
- P2
- P3


Dr Wayne Martindale
01/2023
Summary

• A need to re-think the system, including materials
• Develop solutions for meals
• Be ready for crisis
• Smarten up, connecting data
• Break repetition

“I think in England you eat too much sugar and meat and not enough vegetables.”
Arsene Wenger
A Vision of the Food System, 2045 CE-
Smart People, Smart Processes, Smart Factories

Dr Wayne Martindale, Ph.D FIFST
https://waynemartindale.com/

27th April 2023

Turn-key research in food processing and manufacturing for reducing the impact of climate change
Martindale, Hollands, Hebishy, Jagtap and Duong (2023)
Q&A
Labels and Impact On Consumer Behaviour

Andrea Martinez-Inchausti

Deputy Director of Food Policy
BRC
INSERT SLIDES
Q&A
Lunch
Theme 2: Environment and Nutrition
An Industry With Treasure In Their Trash Bin

Naomi MacKenzie

Co-CEO
Kitro
Q&A
Microbial Protein: The Future of Green Pharming

Matt Longshaw
Senior Scientist
Calysta
Microbial Protein: the Future of Green Pharming

Matt Longshaw, Senior Scientist
Demand for protein is growing rapidly, and shows no sign of slowing...

**More people**
Global population is expected to grow 10% – an incremental 800 million – to 8.5 billion by 2030

**More pets**
Global population of dogs and cats to grow from 900 million in 2022 to 1.1 billion pets (+21% total) by 2030

**More aquaculture**
Global aquaculture production to grow 22% from 2022 to 2030
While food supply systems are vulnerable, with resources strained and production unsustainable,

**Limited natural resources:**
- Arable land & water

Fresh water used for global food production

- Currently 70% of the planet’s freshwater
- By 2050 +15%

Arable land used for global food production

- Currently 40% of land use

**Current protein production systems are unsustainable**

Intensified animal and crop production systems accelerate:
- Climate change
- Pollution – air, soil, water
- Deforestation
- Loss of biodiversity
- Soil erosion
- Animal welfare issues
- Antibiotic resistance
- Unfair working conditions
Calysta is addressing the dual challenge of food security and climate change

**Limited Need for Arable Land**
Land required to produce microbial protein in a Calysta 100,000-ton plant is a fraction of the land use for other protein products (km²); 750 km² - the size of NYC

**Significantly Lowers Water Usage**
Calysta’s microbial protein uses 90% less blue water than equivalent soy protein or wheat production

**Reduce Animal Driven Emissions**
Calysta’s protein can reduce animal meat production and animal methane emission; our 100,000 ton plant is equivalent protein to 1.2 million cattle

1.2 million Cows : 120,000 t methane emission
C1 gas feedstocks are infinitely abundant; Net Zero food production without driving deforestation

C1 compounds (i.e., CO₂, CO/syngas, methane, methanol) are the next generation feedstocks for microbial cell factories to support the sustainable development of a net zero economy.

- C1 compounds are inexpensive, abundant, and widely accessible.
- Using nature-based sequestration of carbon feedstocks from the atmosphere can greatly contribute to the reduction of global warming.
- Methane CH₄ can be produced from CO₂ (air) using Green H₂/renewable energy which Calysta can convert to carbon negative protein (FeedKind 2030).

Land Required to Produce Protein Equivalent to a 100,000 mtpa FeedKind Plant (km²)

- Unlike animal or plant protein products, FeedKind does not need carbohydrates (C₆) for growth or compete with land for photosynthesis.
- Increasing land availability for Soy demand is a driver of deforestation.
- 0.1 sq Km factory (10 soccer pitches) can displace 2,500 km² of soy (annual Amazon forest loss is 10,000 km² in 2021).
Calysta’s protein is inspired by ancient health in nature, with our microbe isolated from hot springs in Bath.

Hot springs have been revered since antiquity for their natural life-giving qualities and were worshiped by the Romans through Sulis / Minerva, the goddess of medicine.

In the 17th-century, doctors began to prescribe the drinking of the thermal waters for internal conditions and illnesses.

The history of Bath is intrinsically linked with the natural hot springs that the city is founded upon. The first shrine at the site of the hot springs was built by an Iron Age tribe called the Dobunni, who dedicated it to the goddess Sulis, who they believed possessed healing powers.
Our bacteria

Consortia working together

- *Methylococcus capsulatus* (>91%)

- *Cupriavidus* sp. (DB3) (6-8%) – consumes oxidation products of alkanes

- *Brevibacillus agri* (DB4) and *Aneurinibacillus danicus* (DB5) (<1%) – suppress spore forming bacteria
Our current process

**STEP 1**
Gases are mixed in a proprietary fermenter where they are consumed by Calysta’s natural microorganisms which form the basis of single cell protein.

**STEP 2**
Single cell protein is separated from the aqueous media in which it is grown, with water and nutrients returned back to the fermentor.

**STEP 3**
Single cell protein is either further processed to purified products or dried and packaged per customer specifications.

**STEP 4**
Products are shipped as ingredients for pet food or animal feed worldwide.
Carbon Negative by 2030

- Natural gas
- CO₂
- Biomethanation

Continuous Fermentation

- Aquaculture and livestock feed
- Single cell protein

Synthetic gas

Renewable Power

O₂

Hydrolysis of Water

H₂
Our products are high-protein, with a complete amino acid profile and additional benefits

Protein content of 71% to 82%; increasing in isolate form

<table>
<thead>
<tr>
<th>Dry weight %</th>
<th>Description</th>
<th>Features / Application</th>
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</thead>
<tbody>
<tr>
<td>Crude fat</td>
<td>Nutritionally dense single cell protein source</td>
<td>Flexibility in formulations through:</td>
</tr>
<tr>
<td>8%</td>
<td>Complete and balanced amino acid profile complimentary to other major sources of protein</td>
<td>- 71% crude protein and 8% fat mean high protein and high calorie value</td>
</tr>
<tr>
<td>9%</td>
<td>Rich in B12 and iron</td>
<td>- Low fiber adds flexibility to formulation and increases digestibility</td>
</tr>
<tr>
<td>N-free extract</td>
<td>Balanced amino acid profile provides excellent nutritional properties</td>
<td>- Balanced amino acid profile provides excellent nutritional properties</td>
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<tr>
<td>7%</td>
<td></td>
<td>- Controlled production process provides consistent year-round product with reduced risk of contaminants (e.g., mycotoxins, pesticides)</td>
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<tr>
<td>Moisture</td>
<td></td>
<td>Protein Isolates unique ingredient properties:</td>
</tr>
<tr>
<td>5%</td>
<td></td>
<td>- High solubility, good emulsion and water binding properties</td>
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<tr>
<td></td>
<td></td>
<td>- Foaming</td>
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<td></td>
<td></td>
<td>- Dark red color</td>
</tr>
</tbody>
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**Ingredient**  | **Typical crude protein content, % crude protein**  | **Average protein content = 53%**
---|---|---
Calysta Protein | 71% |
Soybean meal | 49% |
Rapeseed meal | 38% |
Pea protein | 23% |
Poultry meal | 60% |
Fish meal | 64% |
Meat & bone meal | 56% |
Insect meal | 60% |

Source: Calysta
Calysta’s protein characteristics outperform many other proteins in the marketplace

<table>
<thead>
<tr>
<th>Protein Source</th>
<th>Calysta Protein</th>
<th>Meat Products</th>
<th>Egg Albumin</th>
<th>Whey protein isolate</th>
<th>Soy proteins</th>
<th>Wheat proteins</th>
<th>Pea proteins</th>
<th>Insect proteins</th>
<th>Algal proteins</th>
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<td>0.9</td>
<td>1</td>
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<td>0.9-1</td>
<td>0.2-0.4</td>
<td>0.6-0.9</td>
<td>0.35 - 1</td>
<td>0.6-0.8</td>
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<td>No</td>
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<td>Yes</td>
<td>Yes</td>
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<td>Organoleptic Properties</td>
<td>Neutral</td>
<td>Meaty taste</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Poor to ok</td>
<td>Poor to ok</td>
<td>Poor to ok</td>
<td>Poor to ok</td>
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<tr>
<td>Allergies</td>
<td>Low</td>
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<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Pathogens</td>
<td>Low risks</td>
<td>Some risks</td>
<td>Some risks</td>
<td>Low risks</td>
<td>Low risks</td>
<td>Low risks</td>
<td>Low risks</td>
<td>Low risk</td>
<td>Some risks</td>
</tr>
<tr>
<td>Pesticides / heavy metals</td>
<td>N/A</td>
<td>Low risks</td>
<td>Low risks</td>
<td>Low risks</td>
<td>Risks</td>
<td>Risks</td>
<td>Low risk</td>
<td>Risks</td>
<td>Risks</td>
</tr>
<tr>
<td>Sustainability</td>
<td>Good</td>
<td>Very poor</td>
<td>Poor</td>
<td>Average</td>
<td>Poor</td>
<td>Average</td>
<td>Average</td>
<td>Good Av. - Good</td>
<td>Good Av. - Good</td>
</tr>
</tbody>
</table>
## SCP (Calysta) Safety Credentials

<table>
<thead>
<tr>
<th></th>
<th>Plant Protein</th>
<th>Animal Protein</th>
<th>SCP* Calysta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inherent Bacterial Contamination</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Mycotoxins</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Animal Diseases</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Pesticide &amp; Herbicides</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Environmental Chemical Contamination</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Heavy Metals</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Veterinary Drugs</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Hormones</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
</tr>
</tbody>
</table>

*SCP* stands for Single Cell Protein.

**CALYSTA**
Calysta has validated FeedKind with leading academics, CROs, and aquafeed companies – it outperforms existing proteins.

FeedKind’s value and efficacy has been validated in dozens of species with the world’s leading aquaculture universities.

- Protein is more than 90% digestible.
- FeedKind Helps Reduce Feed Costs
- FeedKind Helps Shrimp Resist Disease
- FeedKind Improve Growth Rate

FeedKind Improve Growth Rate

<table>
<thead>
<tr>
<th>Protein Level</th>
<th>Specific Growth Rate</th>
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<tbody>
<tr>
<td>Control</td>
<td>5.8</td>
</tr>
<tr>
<td>FK 3%</td>
<td>6.2</td>
</tr>
<tr>
<td>FK 6%</td>
<td>6.4</td>
</tr>
<tr>
<td>FK 9%</td>
<td>6.6</td>
</tr>
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</table>

FeedKind Helps Reduce Feed Costs

<table>
<thead>
<tr>
<th>Protein Level</th>
<th>Reduction in Feed Cost</th>
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</thead>
<tbody>
<tr>
<td>Control</td>
<td>$1.00</td>
</tr>
<tr>
<td>FK 2%</td>
<td>$0.92</td>
</tr>
<tr>
<td>FK 4%</td>
<td>$0.94</td>
</tr>
<tr>
<td>FK 6%</td>
<td>$0.96</td>
</tr>
<tr>
<td>FK 8%</td>
<td>$0.98</td>
</tr>
</tbody>
</table>

FeedKind Helps Shrimp Resist Disease

<table>
<thead>
<tr>
<th>Protein Level</th>
<th>% Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>60%</td>
</tr>
<tr>
<td>FK 5%</td>
<td>100%</td>
</tr>
<tr>
<td>FK 10%</td>
<td>100%</td>
</tr>
<tr>
<td>FK 15%</td>
<td>100%</td>
</tr>
</tbody>
</table>

10% Improvement in Growth

Survival to 100%
Commercially validated design using methane for fermentation

- 2000s - $400+ million invested; Operated over 3 years on a “campaign” / run basis by DuPont
- 2014 - Calysta acquired designs and IP from Statoil-Dupont JV (10,000 MT per annum)
- 2017 - Calysta’s demonstration operating pilot plant in Teesside, UK with 50 MT annual capacity
- 2020 – JV between Calysta and Adisseo
- 2022 – completion of 20,000 MT plant in Chongqing, China
- 2023 – Plant commissioned; commercial sales Q2 2023
- 2025 and beyond – 100,000 MT plants in USA and KSA
Challenges

Keeping them Happy and Alive!

Talent & Skills
Single cell proteins

No longer “alternative” the future is now!

Yeast and fungi
- **Protein content**: Yeast 38-52%; Fungi 0.23-15%
- **Characteristics**: Uses different substrates, produce vitamins and micronutrients
- **Limitations**: Possible presence of toxins, limited protein content and poor amino acid profile
- **Examples**: Saccharomyces cervisiae, Kluyveromyces marxianus, Aspergillus oryzae, Yarrowia lipolytica

Microalgae
- **Protein content**: 60-70%
- **Characteristics**: Phototrophic, produce omega-3 fatty acids
- **Limitations**: Scale up, digestibility
- **Examples**: Tetraselmis suecica, Isochrysis galbana, Dunaliela tertiolecta, Chlorella stigmatophora, Spirulina spp.

Bacteria
- **Protein content**: 50-80%
- **Characteristics**: High protein content, grown on C1 substrates
- **Limitations**: Palatability issues, high nucleic acid content, production of toxins
- **Examples**: Methylobacterium extorquens, Methylococcus capsulatus, Rhodobacter sphaeroides, Clostridium autoethanogenum, Afifella marina
Fermentation to create sustainable protein

In the last 10 years, fermentation has emerged as a commercially viable method of replacing animal proteins to feed people, pets and livestock.
The solution – a revolution in protein supply

Our microbial protein, grounded in proven technology, can sustainably address the global protein needs in feed, pet and human food.

Aquaculture and Feed: Protein ingredient in feed for diverse fish including salmon and shrimp, as well as other livestock.

Pets: High-quality protein ingredient for dogs and cats.

Human food: Protein-rich ingredient for fortified foods, bars and nutritional applications.

Whole-cell: Protein-rich additive for alternative protein food manufacturing.

PetProtein: High-quality protein ingredient for dogs and cats.

Protein isolate: Protein-rich additive for alternative protein food manufacturing.

CALYSTA
Calysta’s protein can make scalable contributions to improving sustainably based global food security.

Calysta’s strategy will produce 300,000+ mt per annum by 2027, and nearly 1M mt globally by 2030.

- Our 100,000 mt production site and process can meet the annual nutritional protein needs of 3M+ people*.

- By 2030, Calysta could provide sustainable nutrition equivalent to the protein needs of nearly 30M people per year.

- The Ukraine disruptions have made food security a global imperative; diversification of food sources is a key step.

- In June 2022, the G7 described the disruption as a multidimensional crisis that has left as many as 323 million people around the globe at high risk of food shortages, a record.

Impact across many of the 17 UN sustainability goals, with emphasis on:

- Zero Hunger
- Climate Action
- Life Below Water
- Life on Land

* Assumes 60g protein/day/person, Calysta ~ 70% protein content.
Thank You!

Matt Longshaw, Senior Scientist

jblair@calysta.com
07725203239
Q&A
Shifting the Environment: Making Healthy and Sustainable Diets the Norm in Retail Settings

Dr Vicki Jenneson
Public Health Nutritionist
University of Leeds Institute for Data Analytics
Shifting the environment

making healthy & sustainable diets the norm in retail settings

Dr Vicki Jenneson
ANutr, BSc, MPH, MSc, PhD
Research Fellow, University of Leeds
Food for thought

1. Does healthy *always* mean sustainable?

3. Why is shifting retail environments important?

4. What have we learnt so far?
1. Does healthy *always* mean sustainable?

Exploring definitions, metrics and trade-offs
What is a sustainable diet?

Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources.

FAO, 2010, Sustainable Diets and Biodiversity.
What is a healthy diet?

A healthy diet is one in which macronutrients are consumed in appropriate proportions to support energetic and physiologic needs without excess intake while also providing sufficient micronutrients and hydration to meet the physiologic needs of the body.

*Stark C. Guidelines for Food and Nutrient Intake. (2013)*
EAT Lancet
Planetary Health Diet

To feed a world population of 10 billion people in 2050

Would lead to 11 million fewer premature adult deaths (20% reduction)
UK Government
Eatwell Guide

Just 1% of the UK population currently meet Eatwell Guide recommendations

Aligning to the Eatwell Guide would lead to
- 31% lower GHGEs
- 34% lower land use
- 17% lower water use
- 17.9m more healthy life years
Principles of healthy & sustainable diets

- Healthy
  - Micronutrient rich
  - Variety
  - Less meat & dairy
  - More plants

- Sustainable
  - Less plastic
  - Seasonal produce
  - Local produce
  - Variety
The power to choose

35,000 choices daily

227 related to food

(Wansink and Sobal 2007)
What do sustainable products look like?

No single accepted definition of what a sustainable food is (holistic concept)

Sustainability not communicated well to the consumer

Retailer sustainability metrics are lacking

Life Cycle Assessment evidence required to substantiate green claims
Tesco plant-based burger ad pulled over “misleading” claims about the planet

08 Jun 2022 ---- The UK’s Advertising Standards Authority (ASA) has resolved that a 2021 Tesco ad regarding its own brand Plant Chef plant-based burger was “likely to mislead” the public. The claims under scrutiny were that the burger had “positive environmental differences to the planet compared to their meat equivalents.”

ASA ruled that these ads must not appear again in their current form and for Tesco not to make unsubstantiated claims about their products in the future.

“Because we had not seen evidence...that demonstrated that Plant Chef products could make a positive environmental difference to the planet compared to their meat equivalents, nor had we seen evidence for the full life cycle of the Plant Chef burger, we concluded the claims regarding their positive benefits to the planet had not been substantiated,” concludes ASA.
Product-level choices can make a big difference

- **Focus on carbon emissions**
- **Population-level average** – (total food imports & percentage from each country)
- **Farm to retail** - (discount home cooking)
Produce of

Produce of United Kingdom, Morocco, Netherlands, Spain
What do healthy products look like?

**Nutrient Profile Models** help us quantify the ‘healthiness’ of foods.

**Front of pack labelling** allows key nutrition indicators to be highlighted to consumers.

**Back of pack nutrient panel** puts products in context of individual daily allowances.

**Nutrition and health claims** are regulated and must be backed up with evidence.
Trade offs

Sustainability
- Imported produce
- Depleted fish stocks

Nutrition
- Micronutrient deficiencies
- Ultra-processed foods
- Affordable nutrition
2. Why is shifting retail environments important?

Exploring industry responsibility & the importance of data
Escape the Junk Food Cycle and protect the NHS

• 9/10 people regularly buy their groceries from supermarkets
• The junk food cycle – food environment is flooded with cheap poor quality food, setting us up to fail
• Nearly 300 UK obesity policies in the last 30 years (Theis D, 2021)
The power of retail data

Morris et al
“80% coverage of the Foresight obesity systems map is possible using a wide range of big data sources.

Big data offer great potential across many domains of obesity research and need to be leveraged in conjunction with traditional data for societal benefit and health promotion.”
The role of retail

- Sourcing
- Ranging
- Marketing
- Monitoring
Nutrition And Lifestyle Analytics Team

Michelle Morris
Associate Professor

Vicki Jenneson
Research Fellow

Mariana Dineva
Research Fellow

Fran Pontin
Research Data Scientist

Rayan Onyonka
Data Scientist

Elliot Karikari
Data Scientist

Ann Onuselogu
Former Data Scientist

Alex Dalton
Former Data Scientist

Maddie Thomas
Former Nutrition undergraduate
3. What have we learnt so far?

Case studies from the IGD Healthy & Sustainable Diets programme trials
IGD Healthy & Sustainable Diets trials

Challenge

The food we consume is bad for our health and our planet. Only 1% of the UK population meet Eatwell Guide dietary recommendations.

But changing our behaviours is hard.

5 behavioural levers have been proposed as promising to nudge customers towards healthy & sustainable choices in store.

What we did

Worked with the IGD to engage their Healthy and Sustainable Diets working group members (20+ retailers & manufacturers) to:

- Evaluate existing industry initiatives
- Co-design & implement new interventions
- Share industry-wide knowledge on what works to shift customer behaviour

Data

Transactions

- Transaction ID
- Customer ID
- Product ID
- Amount (units)
- Spend (£)

Customers

- Customer ID
- Area of residence
- Gender
- Age band

Products

- Product ID
- Category
- Sub-category
- Weight
- Nutrients/100g
Trial metrics

Challenge

Developing a set of common metrics which can be used across retailers to evaluate trials.

Incorporate aspects of health and sustainability (despite data limitations).

Sales – interrupted time-series

Basket composition – Eatwell Guide analysis
IGD behavioural levers

Signposting
- Does the messaging help normalise change?
  - Use signage or educational messaging to highlight better choices. Keep messaging simple and focus on positive language to help normalise change.

Placement
- How are the options presented?
  - Optimise product placement, both in-store and online, to make healthy sustainable choices easy. Consider solutions that support people with meal planning.

Product
- Do the options appeal to your target audience?
  - Use language and imagery to ‘frame’ healthy, sustainable choices as appealing. Health shouldn’t always be the primary focus.

Influence
- Are there any social influences present?
  - Make it easy for people to try something new. Recommend ‘simple swaps’ to existing recipes to help normalise healthy, sustainable choices.

Incentivisation
- Is there anything that motivates us to try something new or do it again?
  - Incentivise trial of healthy sustainable options.
Sainsbury’s reduced the price of some fruit and veg products to 60p, throughout January for 2 consecutive years (2020 and 2021). Examined impact on sales.

Findings

- Sales of fruit and vegetables increased by 78%
- Diets shifted towards the Eatwell guide
- The trial was most effective for higher value tropical fruits
- Fruit and vegetables not on promotion also saw an uplift
- Effects lasted for 3 weeks of the 4 week trial & were not sustained long term
What we did

Asda moved plant-based items next to their meat-based counterparts within the fresh meat bay for 12 weeks.

Findings

- Sales of relocated products declined by 30%
- This decline was greater in urban and more deprived areas
- Customers did not switch to other categories such as meat or frozen, suggesting they shopped elsewhere for their plant-based products
- Plant-based shoppers were reluctant to explore the meat aisle so couldn’t find the products they were looking for
- Meat eaters weren’t persuaded to purchase plant-based options, potentially put off by their higher price tag
- ASDA has since committed to increasing their vegan range by 50% in 2023, and improving the price comparability with meat
Trials outputs to date

• 2 retailer master collaborations
• 3 year collaboration (ongoing)
• 4 IGD Driving Change reports
• 5 retailer trials
Data gaps

- Product weight data
- Product-level sustainability data
- Crossover between sustainability & nutrition
- Food system digital twin
- Sustainability labelling
What is needed?

- Government intervention
- Connected supply chain data
- Retail data gaps
- Better health for people and planet
- Consumer choice

Retailer decisions
Thanks for listening!

A challenge to industry

What decisions would you make for the food system if you were designing for you?
Q&A
Break
Theme 3: Nutrition and Food Security
Innovation Sweet Spot: Steering Food Technology Towards Improving Health and Food Environments

Parita Doshi
Deputy Director
A Healthy Life Mission - Nesta
Innovation Sweet Spot: Steering food technology towards improving health and food environments

Parita Doshi - Deputy Director, A Healthy Life Mission, Nesta
About Nesta

We are the UK’s innovation agency for social good. We design, test and scale new solutions to society’s biggest problems, changing millions of lives for the better.

For over 20 years, we have worked to support, encourage and inspire innovation that benefits society, a purpose that is more relevant now than ever.

→ Read more about our history
**A fairer start**
Narrow the outcome gap between children growing up in disadvantage and the national average.

**A healthy life**
Increase the average number of healthy years lived in the UK, while narrowing health inequalities.

**A sustainable future**
Accelerate the decarbonisation of household activities in the UK and improve levels of productivity.

**Our roles**

- **Innovation partner**
  Design, test and scale innovative solutions hand in hand with those who will use them.

- **Venture builder**
  Create, support and invest in early-stage ventures to develop new solutions and shift key markets.

- **System shaper**
  Influence wider systems of policy, practice and funding to support and promote innovation.
Our approach to innovation harnesses the **collective power of different disciplines, methods and perspectives** to help us see problems in new ways, borrow solutions from different fields, and continually push boundaries of what we think is possible. Our expertise includes:
A healthy life

Our mission is to increase the average number of healthy years lived in the UK, while narrowing health inequalities.

At Nesta, we are focusing on halving the prevalence of obesity by 2030.

We do this by designing, testing and scaling solutions that drive the change needed: changes in our food environment – the places we shop, the foods we buy, the streets we walk on – to make healthy eating easier and more appealing.
What surrounds us shapes us...

The food environment is made up with everything we experience in a place that relates to food.

This could be your:

Workspace
Online Spaces
Neighbourhood

- The price of healthy options
- Advertising and promotions that we are exposed to
- The availability of healthy options stocked by retailers
- How convenient it is to find, prepare and eat healthier foods
- Portion sizes of meals in restaurants, takeaways and ready meals
- The range of healthy products developed by food manufacturers
Innovation Sweet Spots: Food innovation, obesity and food environments
Innovation Sweet Spots at a glance…

- VC investment
- Patents
- Futures wheel
- Expert survey
- Research funding
- Public discourse
- Expert interviews

Quantitative analysis + Sensemaking and foresight

Food tech and innovation trends
Capturing multiple aspects of the innovation system

Expert insight
Capturing insights on the potential impact of food tech and innovations

nesta
Food tech and innovation landscape

Innovative food
- Alternative protein
- Reformulation

Health
- Personalised nutrition
- Biomedical
- Dietary supplements
- Diet
- Agritech

Nutrition
- Calories
- Affordability
- Proximity
- Convenience

Cooking and kitchen
- Kitchen tech
- Dark kitchens

Delivery and logistics
- Delivery
- Meal kits
- Supply chain

Food waste
- Packaging
- Waste reduction

Restaurants and retail
- Restaurants
- Retail

Innovation category (core focus)

Innovation subcategory (core)

Innovation category (non-core)

Impact areas

nesta
What we found
A wave of innovation: A surge of research and investment has given rise to a host of food innovations.
BUT…

🤔 We question is the wave heading in the right direction?

AND…

🤔 Suggest what could be done to steer the wave
Investment boom in food delivery and logistics: A challenge for the quality of food environments?
Findings

Rapid growth for dark kitchens

Emerging kitchen automation and robotics investment

Massive investment into deliveries
Alternative proteins: An area of rapid growth but with unclear implications for health.
Figure 14. Global investment into alternative protein start-ups
Early stage deals, e.g., seed and series funding (£ billions)

Subcategories: ▄ Plant-based ▓ Fermentation ▃ Lab meat ▒ Insects

Source: Nesta's analysis of Dealroom data • Analysis aimed to include companies producing protein for human consumption only. Dashed lines indicate the most recent (incomplete) data for 2022.
The rise of innovation in reformulation: Good news for the future of our health?
Findings

Figure 29. Global patent applications for reduced calorie food stuffs
Patents that add substantially indigestible additives such as dietary fibre (Group 1) or use other mechanisms to reduce calories (Group 2)

Figure 31. Global applications for satiety-increasing food patents
Patents were identified using search terms and subsequent filtering by patent symbols related to food (as there are no patent symbols for satiety as such).

580% growth in 2010-2020
Our work investigating targeted reformulation
Modelling halving obesity by 2030

Achievable by a reduction of \( 216 \text{ kcal} \) daily on average
And what impact targeted reformulation could have...

A 10% reduction would remove...

38 kcal/day per person

⅕ of what we need to reach our goal
Creating a multi-dimensional view of the food tech system

Findings

Growth across the board for investment (however, market now in downturn)

Varying strength of trends in UK research

Public discourse more active in media than parliament

Explore the interactive version on the report’s website (see Figure 5)
## Findings

Reformulation scored the highest in terms of potential to reduce obesity.

Meal kits, weight loss injections and personalized nutrition also ranked high.

The long-term health impact of alternative proteins is unclear.

Dark kitchens, kitchen automation and food deliveries ranked low.

---

### How technologies scored for both likelihood to reduce and increase obesity

<table>
<thead>
<tr>
<th>Technologies</th>
<th>Reduce obesity score</th>
<th>Increase obesity score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reformulated products which are low calorie or high satiety</td>
<td></td>
<td></td>
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<tr>
<td>Cook at home meal kits</td>
<td></td>
<td></td>
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<tr>
<td>Weight loss injections and other medical interventions</td>
<td></td>
<td></td>
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<tr>
<td>Personalised nutrition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fermentation to produce proteins (precision and traditional)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smart packaging which reduces spoilage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-personalised dietary supplements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant-based meat and dairy products</td>
<td></td>
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<tr>
<td>Dark kitchens</td>
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<tr>
<td>Smart consumer kitchen tech</td>
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<tr>
<td>Kitchen robots for industry and food service</td>
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<tr>
<td>Lab meat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Takeaway delivery apps</td>
<td></td>
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<tr>
<td>10-minute grocery delivery services</td>
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<tr>
<td>Apps and automatic touchscreens replacing staff at shops and restaurants</td>
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Source: Nesta's survey of experts in the food sector across private, public and third sectors - The survey was carried out using a 'pairwise surveying' method (eight expert participants; 375 pairwise votes in total). Higher score indicates higher perceived likelihood across the expert panel.
It appears that innovations in this space aren’t driven by or enabling health.

So what can we do about it..?
**Recommendations**

**Fiscal incentives**

- HMRC should introduce corporate tax relief for retrofitting food production plants to enable process innovation to reduce calories
- UK Gov should explore a Health Innovation Levy
- UK Gov should put in place Mission-Oriented tax credits and business rates reduction
- British Business Bank should co-invest with private sector capital in food tech companies with positive impact on health

**Consumers**

- UKRI should fund more research and experimentation addressing consumer concerns around food innovations
A taster of some of our other work…
Thank you very much!
Questions?
Q&A
Regenerative Food Innovation: How We Can Tame Food Processing To Relive The Pressures On Food Security and Sustainability

Prof. Charles Brennan

Executive Dean of School of Sciences
RMIT University
INSERT SLIDES
Q&A
POLL #2

https://app.sli.do

#4271 758
PANEL SESSION: GETTING THE BALANCE RIGHT

Chair

Kate Halliwell
Chief Scientific Officer
Food & Drink Federation

Oliver Camp
Senior Associate
GAIN

Dr Joanna Trewern
Head of Consumption
WWF-UK

Nathan Barnhouse
Director for Wales
FSA

James Lloyd-Jones
Founder
Jones Food Company
Closing Remarks

Barbara Bray MBE, FIFST
Spring Conference Chair
2023
We want to hear from you!
Scan the barcode to take our survey.

IFST Conference

IFST Wales Branch
Thank you

See you next year!