New and emerging ingredients
A critical part of your R&D strategy
Welcome to Leatherhead’s member only webinar

New and emerging ingredients

Jenny Arthur
Head of Membership and Nutrition

Annie-Laure Robin
Senior Regulatory Consultant
New and emerging ingredients

Science and technology
- Mechanical
- Biological
- Chemical

New and emerging ingredients

Consumer perception
- Communications
- Understanding
- Motivation

Regulatory compliance
- Permissibility
- Safety
- Validity of Claims
We’ve operated a membership programme since 1919, giving our members preferential service. Today, our 1,200+ member companies range from start-ups to the largest household brands all over the globe.

Member benefits include:
- On-demand access to our experts
- Member-exclusive insight
- Discounted fee rates
- Networking
Membership provides on-demand access to expertise, information and insight. It is the simplest way to do business with us.

Benefits:
• Access to a diverse team of highly skilled food & beverage consultants
• An independent perspective to challenge thinking
• Ability to focus on the things that matter

EXPERTISE
On-demand access to Scientific and Regulatory Affairs, Technical and Consumer Science expertise for short enquiries. A discounted rate on larger projects

INFORMATION
Regular updates making it simple to stay abreast of industry news and developments

INSIGHT
Content and events exclusive to members, addressing key trends
Traditional focus on scale and efficiency

Scale and efficiency of production

The changing consumer

Emerging trends
New focus on personalisation

- Personalisation
- The changing consumer
- Emerging trends
Consumer drivers

Key consumer drivers

Lack of trust
Moving away from processed food

Changing diets
New ingredients need to work harder

New and emerging ingredients webinar
Consumer demands

Key consumer drivers

Lack of trust
Moving away from processed food

Changing diets
New ingredients need to work harder

Meeting consumer demands

Sustainability and ethical sources
Health and wellbeing
New sensory experiences
New sources

Clean and natural

Changing diets

New and emerging ingredients webinar
Different approaches.....

Start a fresh

Stretch and protect
New technology opportunities
3 areas of technology to develop new and emerging ingredients

**Mechanical**
- Grinding
- Extrusion cooking
- High/ultra-high pressure
- Emulsification

**Biological**
- Enzymatic
- Microbial
- New sources

**Chemical**
- Acids & alkalis
- Cross-linking agents
- Solvent treatments
Key themes for development of new and emerging ingredients

1. Saturated fat reduction (chemical and mechanical)
2. Clean label (biological)
3. Increasing dietary fibre (biological)
4. Sugar reduction (biological)
5. To increase nutrient content (mechanical and chemical)
Challenge 1:
Reducing saturated fat content

Going beyond conventional emulsions to reduce saturated fat content

Conventional Research
- Oil-in-water emulsions
- Water-in-oil emulsions
- Multiple emulsions (WOW and OWO)

Emerging Research
- Structured emulsions
- Oleogels

Enhanced delivery of functional properties of current mainstream ingredients

**Challenge 1:**

Reducing saturated fat content

## OLEOGELS

A process of converting liquid oil into gel-like material without modifying the chemical characteristics of oil

1. Biphasic gels – using thickening and gelling agents to create viscous or gelled systems capable of carrying oil droplets

2. Utilisation of lipid-based gelators – Adding waxes or fatty acids or fatty alcohols into the oil phase above their melting points and cooling to lower temperatures under shear or stationary conditions

### Bakery fats

- high solid content – high saturated (solid) fat content
- Reduce saturated fat content by using liquid (low sat) oil – structure it into gel-like consistency

### Meat products

- Reduction of total fat content in meat products – replace animal fat with oleogels
- Improve fatty acid profiles – use structured “liquid oil”


Challenge 2: Removing artificial additives and preservatives

Utilising ‘natural’ ingredients for preservation of food

Key challenges

1. Consumers want ‘natural’ products prepared with ‘natural’ ingredients
2. Matching the efficiency and effectiveness of synthetic/chemical preservatives in terms of microbiological spectrum and shelf life period, in soft drinks, desserts and baked goods

Mixing ingredients for synergistic effects

All about creating mixtures that would deliver more than the sum of the functional properties of their individual components

- Working with currently available ingredients
- Reduced pressure on cultivating new ingredients

- Plant-based oils from common crops
- A combination of coriander oil and cumin seed oil exhibited synergistic antibacterial activity
- The synergistic interaction may increase their antibacterial and antioxidant efficacy at sufficiently low concentrations
- Could be used as a potential source of safe and potent natural antibacterial for the pharmaceutical and food industries

“...a consequence of interaction among different chain polymers and formation of mixed junction zones...”

Non-gelling Locust Bean Gum + Non-gelling Xanthan = Gelling system

Challenge 3: Incorporating dietary fibres

Exploiting new technologies: to improve dietary fibre content & solubility

Key challenge:
1. Meeting country fibre targets
2. Incorporating dietary fibre into a wide range of products which influence taste, texture, shelf life and stability

Increasing dietary fibre content and solubility

Using enzymes (biological)
“…a controlled natural enzymatic process that breaks guar gum down into small units…” that has been applied to guar gum (SunFiber)
Challenge 4: Reducing sugar content using proteins

Key challenges
1. UK SACN report in 2015 Carbohydrates and health - new free sugar intake recommendations of 5% of daily intake and PHE sugar reduction targets in 9 categories
2. A long way from achieving the perfect and identical replacement for sugar – taste and texture must not be compromised alongside with shelf life stability and safety for all sweet products, including confectionery, soft drinks, desserts and baked goods

Monellin (MNEI) – isolated from Serendipity berry
*Dioscoreophyllum cumminsii*
- 3,000 times sweeter than sucrose

Brazzein – isolated from West African fruit of climbing plant Oubli
*Pentadiplandra brazzeana Baillon*
- 500 – 2000 times sweeter than sucrose

Miraculin – glycoprotein isolated from fruit of Synsepalum dulcificum
- Not sweet itself but make the sour products taste sweet
- Glycoprotein binds to the sweetness receptors on the tongue, therefore causing sour fruits, sour foods and sour drinks to be perceived as sweet
Challenge 5:
Improving the nutrient profiles of products

Using plant cross-breeding technology to eliminate malnutrition

Key challenges
1. A better way of increasing nutrient content
2. Supplementation of products is a challenging additional step in the production line, some of the poorest communities may not have access to processed food

Reformulated baked beans
Assuming baked beans product:
• contain 65% iron-biofortified beans
• has 5% processing loss
• the product could contain just above 2.1 mg/100g iron

<table>
<thead>
<tr>
<th>Reference Intakes</th>
<th>14 mg [Fe] in UK</th>
<th>Calculated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source of 15%</td>
<td>2.1 mg per 100g product</td>
<td></td>
</tr>
<tr>
<td>High in 30%</td>
<td>4.2 mg per 100g product</td>
<td></td>
</tr>
</tbody>
</table>

Increasing iron, zinc and vitamin A contents of rice, wheat, pearl millet, common bean, maize, cassava, orange sweet potato, banana/plantain, lentils, Irish potato, cowpea and sorghum through
CONVENTION PLANT BREEDING

Source of iron
Regulatory considerations
Complex regulatory framework

New food or beverage product

Compositional standards

Weights and measures

Dietary supplements

General labelling

Marketing claims

Contaminants

Traceability

Novel ingredients

Extraction solvents

General food safety

Functional/health claims

Nutrition claims

Hygiene legislation

Lot marking

Nutrition labelling

Permitted additives/flavourings/enzymes/colour additives

GM ingredients

Pesticides

Allergens

Dietary supplements

Hygiene legislation

Marketing claims

Contaminants

Traceability

Novel ingredients

Extraction solvents

General food safety

Functional/health claims

Nutrition claims

Hygiene legislation

Lot marking

Nutrition labelling

Permitted additives/flavourings/enzymes/colour additives

GM ingredients

Pesticides

Allergens

Dietary supplements

Hygiene legislation

Marketing claims

Contaminants

Traceability

Novel ingredients

Extraction solvents

General food safety

Functional/health claims

Nutrition claims

Hygiene legislation

Lot marking

Nutrition labelling

Permitted additives/flavourings/enzymes/colour additives

GM ingredients

Pesticides

Allergens
Market specific advice can accelerate product launch timelines.
Diversity of pre-market approvals between markets

- Substance for new food use
  - Food additive petition
  - GRAS notification

- New ingredient
  - Novel foods
  - Food improvement agents
Diversity of pre-market approvals between markets

- New ingredients
  - Novel foods
  - Food additives

- New ingredient
  - Novel foods
  - Food additives (inc. flavourings)
  - Processing aids
  - Food enzyme
EU novel food categories

- Vitamins and minerals and other substances used in food supplements, fortified foods and foods for specific groups
- From cell culture or tissue culture derived from animals, plants, microorganisms, fungi or algae
- From animal (including cloned animal)
- From fungi/micro-organism/algae
- New molecular structure
- Engineered nanomaterials
- Produced with novel process
- Food used exclusively in food supplements within the EU before May 15, 1997, intended to be used in foods
- From material of mineral origin
- From plants or their parts

Source: © European Union
EU novel food opportunities

- Vitamin K2
- Isomaltulose
- Nano vitamins
- Cultured meat
- Antarctic krill oil
- UV-treated mushrooms *Agaricus bisporus*
- Yeast beta-glucans
- Conjugated Linoleic Acid (CLA)-rich oil
- Chia seeds
- Clinoptilolite

*Source: © European Union*
The overarching framework can significantly impact commercialisation.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Applicant</th>
<th>Submissions</th>
<th>Filing</th>
<th>Granted</th>
<th>Total time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>EU Novel food</td>
<td>01 March 2005</td>
<td>14 Dec 2005</td>
<td>10 months</td>
</tr>
<tr>
<td>Krill oil</td>
<td>Neptune</td>
<td>GRAS Notice No. 242</td>
<td>04 Feb 2008</td>
<td>14 Oct 2008</td>
<td>8 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EU Novel food</td>
<td>02 Oct 2006</td>
<td>12 Oct 2009</td>
<td>3 years</td>
</tr>
<tr>
<td>Ice structuring protein preparation</td>
<td>Unilever</td>
<td>GRAS Notice No. 117</td>
<td>30 Oct 2002</td>
<td>17 April 2009</td>
<td>6 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EU Novel food</td>
<td>16 June 2006</td>
<td>22 April 2009</td>
<td>3 years</td>
</tr>
<tr>
<td>Plant sterols</td>
<td>ADM</td>
<td>GRAS Notice No. 61</td>
<td>27 Nov 2000</td>
<td>18 April 2001</td>
<td>5 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EU Novel food</td>
<td>02 Nov 2001</td>
<td>31 March 2004</td>
<td>2.5 years</td>
</tr>
<tr>
<td>Diacylglycerol oil</td>
<td>ADM</td>
<td>GRAS Notice No. 115</td>
<td>05 Sept 2002</td>
<td>24 Feb 2003</td>
<td>6 months</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EU Novel food</td>
<td>14 April 2002</td>
<td>23 Oct 2006</td>
<td>4.5 years</td>
</tr>
</tbody>
</table>

Comparison of selected US GRAS vs EU Novel Food submission timelines

Sources: FDA GRAS Notice Inventory & © European Union
There are high success rates for approvals

Application success of EU novel food dossiers 1997 – present (EC)

Source: © European Union
And many of these novel foods deliver against consumer needs.

The different types of novel foods approved in the EU since 1997

- Oil & Lipids
- Botanical extract
- Saccharides (poly-, di-, mono-, tri-, tetra-)
- Exotics (noni, baobab, chia, haskap, sorghum, kippist)
- Protein/Peptides
- Additives as nutritional substance
- New process
- New vitamins/minerals
- Algae extract
- Carotenoids
- Enzyme preparation
- Exotics (noni, baobab, chia, haskap, sorghum)
- Micro-organism
- Plant sterols

Source: © European Union
In summary
In Summary

• When using new and emerging ingredients it is key to consider the science, consumer perspective and regulatory requirements in tandem as each product will be different and there is no one perfect solution.

• There are a range of existing solutions that can help you but which is the most suitable depends on the product, brand, consumer base and regulatory landscape which will differ in each market.

• Need to be aware that success in one market does not guarantee success in another market.
Questions