Welcome to Food Innovation Gateways
Food Structures – Formation, Functionality and The Future

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<tr>
<td>9.15am</td>
<td>Registration, tea/coffee and viewing of exhibits and interactive areas.</td>
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<td>9.45am</td>
<td>Welcome with Dr. Sean Hogan and Introduction with Professor Gerry Boyle, Director.</td>
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<td>10.00am</td>
<td>Professor Stephan Drusch, Technical University of Berlin. Interfacial Properties and Impact on Functionality in Spray-dried Emulsions.</td>
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<td>Dr. Christopher Hartmann, Nestlé Research, Lausanne. Oral Breakdown and Food Structural Design.</td>
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<td>Professor Sylvie Turgeon, Laval University, Quebec. Relationships between Nutrient Bioaccessibility and Dairy Matrices.</td>
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<td>Tea/Coffee and viewing of exhibits and interactive areas.</td>
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<td>12.00pm</td>
<td>Professor Sally Glass, University of Melbourne. The ARC Dairy Innovation Hub: an Australian Perspective.</td>
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<td>12.30pm</td>
<td>Dr. Alessandro Ferragina, University of Padova. Applications of Spectroscopic Techniques in the Agri-Food Sector.</td>
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<td>Dr. Tamara Manuelian, Arivis AG, Rostock. Food Material Research - 3D Imaging and the World of Virtual Reality (VR).</td>
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<td>Lunch and viewing of exhibits and interactive areas.</td>
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Exhibition Stands

1. Prepared Consumer Food Centre
2. DAIRY DRY & Novel Drying Technologies
3. Moorepark Technology Ltd and Teagasc Food Innovation Hub
4. Importance of Meat Structure for Eating Quality
5. Advanced Sensory Techniques for Food Product Innovation
6. Flavour Chemistry Analysis
7. Cheese Structure
8. Bakery Innovation and Novel Structures
9. VistaMilk – Digitalising Dairy
10. National Food Imaging Centre
11. Interactive Area 1
12. Interactive Area 2
Prepared Consumer Food Centre

Presenters: Eddie O’Neill & Roisin O’Malley

The Prepared Consumer Food Centre (PCFC) has been established by the Department of Agriculture, Food and the Marine in consultation with Teagasc, Food Drink Ireland’s Prepared Consumer Food company members, Enterprise Ireland and Bord Bia. The PCFC supports research, development and innovation in Prepared Consumer Food companies, maximising value creation opportunities and addressing the challenges across the industry. Going forward, it will enable the adoption of technology to enhance consumer demands, increase competitiveness and ensure sustainability.

The Centre, based at Teagasc Ashtown, contains state-of-art pilot scale processing equipment which PCF companies can use for research and development in collaboration with Teagasc and other innovation support organisations. It also encompasses access to modern analytical and sensory laboratories to characterise foods in terms of nutritional, compositional, microbial and sensory profiles allowing complete product and process development.

DAIRY DRY & Novel Drying Technologies

Presenters: Noel McCarthy, Sharon Montgomery and Eoin Murphy (Teagasc); Seamus O’Mahony (UCC)

There is growing market for high protein powdered dairy ingredients that can be incorporated into nutritional food and beverage products targeted at early stage life and healthy aging.

DairyDry, an innovative major collaboration bringing together Ireland’s leading research centres through an integrated approach combining existing food chemistry expertise (UCC), advanced imaging expertise (Teagasc, UU, WIT), new processing technology (Teagasc) and sensors leveraged from the ICT industry (CAPPA-CIT), is seeking to identify the precise cause of insolubility in the high protein powders and to address issues both in the liquid concentrate and during spray drying.

A novel drying platform will develop centre of excellence focussed on innovative alternatives to spray drying to support sustainability and profitability within the industry including:

- Develop low CAPEX and OPEX solutions for processing of high-volume, low-value streams co-product streams such as permeate (in collaboration with INRA/VOMM)
- Develop an electrostatic spray drying platform for bioactive stabilisation and enhanced functionality in high value nutritional products
- Create a “whole foods” dehydration platform based on microwave assisted drying to create new dried consumer product formats (including cheese) with pan global reach can be valorised in distant markets
Moorepark Technology Ltd and Teagasc Food Innovation Hub

Presenters: Kieran Downey, John Hunter & Brendan Lyons

Moorepark Technology Limited (MTL) provides commercial pilot plant & research services for food industry customers. It is a joint venture company established by Teagasc with shareholders from the Irish Dairy Industry. MTL operates a modern pilot plant covering 3,000 sq. metres floor area and contains the most up-to-date and versatile pilot scale processing equipment. The plant is of sufficient scale to accurately simulate commercial food processing and has been assembled specifically for research/development and pre-commercial scale manufacturing in product areas such as dairy products and dried food ingredients. A €10m upgrade and expansion project is currently underway at the MTL facility.

Teagasc’s Food Innovation Hub, which is expected to open in July 2020, will allow food and dairy related companies to rent high quality laboratories and offices in location at Moorepark. This will facilitate their own R&D teams to collaborate with Teagasc researchers and use the high tech Moorepark Technology Limited pilot plant.

The concept of the Food Innovation Hub is straightforward; it integrates three major components; the state of the art pilot plant facility – Moorepark Technology Limited (the “hardware”), the Teagasc Food Research Centre Moorpark’s research capability (the “software”); and custom designed secure company laboratory and office units (the “Industry Units”). The Food Innovation Hub Industry Units will contain private, secure company dedicated offices, laboratories and temperature controlled storage space. The Hub will also include a board room and training centre and full ICT infrastructure and support will be in place.

Importance of meat structure for eating quality

Presenters: Ruth Hamill, Ciara McDonnell & Karthikeyan Palanisamy Thangavelu

Fresh and processed meat products are complex matrices, in which the structure of the food has a direct impact on sensory properties, such as texture, flavour, juiciness and visual appeal. Production and processing parameters, and their interaction with the physiology of muscle during the muscle to meat conversion process, have an effect on meat structure and ultimate product quality. On the other hand, processed meat products represent complex structures that can be considered as a matrix of interacting components. Aspects of structure and physiochemical information can be captured and used to predict eating quality of fresh and processed meat systems, for example, using spectroscopy and image analysis. In addition, advances in new techniques such as the combination of computer tomography with virtual reality applications could provide us with further information on meat structure. With a view towards improving the consumer appeal and health profile of meat products and in exploring the possibilities of developing meat-based functional foods, we have focused on furthering our understanding of the impact of interactions between the food matrix and novel ingredients on technological and sensory performance. We have developed strategies to optimise healthier versions of traditional meat products such as reduced fat and salt prototypes with excellent sensory properties, or products including innovative ingredients and bioactive compounds, by harnessing novel technologies such as power ultrasound, high-pressure processing and 3D food printing.
Advanced Sensory Techniques for Food Product Innovation

Presenters: Emily Crofton, Carol Griffin, Cristina Botinestean & Chris Ovenden

The sensory science suite at Teagasc Food Research Centre, Ashtown is a state-of-the-art facility built around a programme of activities encompassing high quality research, service provision and training. Researchers can offer companies an array of sophisticated sensory evaluation techniques to enable the development of innovative food products with optimal consumer benefits. Our areas of expertise include descriptive sensory evaluation (traditional and rapid methods), temporal sensory techniques and using novel biometric technologies to improve consumer testing. Teagasc have screened and trained three external sensory panels to characterise and unravel the complex flavour and texture profiles of foods, with a particular focus on meat. These expert panels are available to the food industry for a wide range of applications including product development, quality control and shelf-life evaluation. These panels are also an important tool in Teagasc’s current research programme, participating in studies of cross-cultural sensory perception. Sensory evaluation is conducted in our sensory suite at Ashtown, which is equipped with 18 individual computerised testing booths and specialised cooking equipment. All booths are equipped with adjustable lighting (white, red and green), together with the latest sensory data collection software, Compusense Cloud®.

Flavour Chemistry Analysis

Presenters: Kieran Kilcawley and David Mannion

The Teagasc Food Research Programme has extensive sensory and flavour chemistry capabilities and expertise. Our flavour chemistry facilities include state-of-the-art gas chromatography detection systems with various automated discrimination techniques specifically tailored for the analysis of aromatic compounds. All research facilities and associated expertise are available to support industry in product development, characterisation of flavour/aroma, product matching and identification of off-flavours/taints from food and beverages.

Cheese Structure – Creating Functionality for the Future

Presenters: Diarmuid Sheehan, Prateek Sharma, Ram Panthi & Prabin Lamichhane

Cheese manufacture accounts for ~ 30 % of Irish milk with exports valued at € 819 m (2017: CSO). Teagasc has extensive expertise in Cheese Science and Technology, with an associated analytical capability, and is well placed to deliver research to underpin innovation. The current research platform is focused on; application of membrane processes to cheese manufacture; casein-polymer interactions to develop platform technologies to exploit emerging Asian markets; decoupling the role of casein-mineral interactions and casein hydrolysis in continental cheese quality; unravelling “The Cheese Matrix Effect” in promoting healthy cheese and; application of new microwave based technologies in cheese innovation.
Bakery Innovation and Novel Structures

**Presenter:** Eimear Gallagher and Laura Milner

Teagasc conducts fundamental and applied research in the areas of cereal science and baked goods. This includes novel bakery formulations and structures, flour chemistry and rheology, fortified breads and healthier snacks. We also have significant experience in the gluten-free area (e.g. starches, alternative protein sources, alternative grains), and we have used mathematical modelling techniques to create new structures for enhanced quality. We are able to offer extensive advice in the area of ingredient selection and baking practices for bakery and snack formulations. Our facilities include a mill room, test bakery, dough rheology lab, cereal chemistry lab and 18 computerised sensory booths.

VistaMilk – Digitalising Dairy

**Presenters:** Donagh Berry, Tom O’Callaghan and Deirdre Hennessy

The VistaMilk SFI Research Centre aims to be an agent of growth for the Irish dairy industry propelling Ireland into pole position in fundamental and translational research for precision pasture-based dairying. The centre represents a unique collaboration between Agri-Food and ICT research institutes and leading Irish/multinational food and ICT companies. VistaMilk is hosted by Teagasc, in partnership with the Tyndall National Institute, the Telecommunications Software & Systems Group at Waterford Institute of Technology, the Irish Cattle Breeding Federation, and the Insight Centre for Data Analytics. The VistaMilk SFI Research Centre will develop new, and advance existing electronic monitoring and actuation technologies to transform an already world-class dairy sector into a global leader in sustainable Agri-Tech. It will specifically address pasture-based dairy production, improved processability and the generation of novel, higher-value-added products. In addition to the creation of new sensing and actuation paradigms, particular focus will be given to developing state-of-the-art analytical techniques applied to large scale, sensor data-sets delivered by advanced network and communication technologies. The opportunities that arise at the interface between Agri-Food and ICT will be the basis for the competitive advantage and international reputation of the centre.

National Food Imaging Centre

**Presenters:** Deirdre Kennedy and Laura Gómez-Mascaraque

The National Food Imaging Centre (NFIC) is a unique and powerful set of tools dedicated to the Irish agri-food sector. It comprises conventional optical, confocal scanning laser, confocal Raman, scanning electron and atomic force microscopes. Researchers at the Teagasc Food Research Centre exploit this cutting-edge microscopy platform to study and understand different aspects of the food nano – and microstructure. Teagasc’s team provide specialist know-how, facilities and services in food structure characterisation, and are available to perform contract or collaborative research with companies for product troubleshooting and to help develop new products.
Interactive Area 1

Presenters: Norah O’Shea, Gonzalo Delgado-Pando, Deirdre Kennedy and Vinay Mishra.

**Robotics:** Teagasc is using robotics to develop a platform for the measurement of the rehydration properties of powders. A seven-axis robot can mimic the movements that humans use to reconstitute powders, such as milk powders. The robot enables controlled rehydration of the powder consistently across batches of products, facilitating measurements free from variability due to human intervention.

**Virtual Reality:** Imaging software is a powerful tool for analysing food structures and relating these structural properties to other attributes. Teagasc is using virtual reality to see inside our food and examine how it looks on the inside. The technology will enable food manufacturers identify key structural components that contribute to high-quality foods. Researchers in Ashtown Food Research Centre have used this technology in bread and meat applications and researchers in Moorepark Food Research Centre are investigating its applications in dairy products. Key components can be identified and analysed using image analysis associated with the software. This technology can visualise complete structures in 3D, allowing it to become a completely immersive experience.

**3D printing** is recommended as a technology of the future, its application has not yet been fully explored in the food sector. Benefits of 3D printing include flexibility to fabricate products in any shape or size, optimal and efficient use of ingredients, and end-products with personalized nutrition. Currently, Teagasc is developing its own tailor-made 3D printer that will print 3D dairy snacks using dairy inks derived from Irish dairy ingredients.
Interactive Area 2

Presenters: Gloria Keicher, Kamrul Haque, Valentyn Maidannyk, Zara Bolger, André Brodkorb

Physical characterisation of food structures plays an essential role in food product design and manufacture. Teagasc employs a wide range of analytical techniques to determine the contribution of ingredients to food structure – from the molecular right through to bulk food products. This Interactive Area demonstrates some of the technologies employed by Teagasc to better understand formation and stability of food structures.

**Drop Tensiometry** is an elegant technique used to determine surface and interfacial tension in emulsion, foam and wetting applications. Measurements involve acquisition of a drop image by high-speed camera and calculation of surface tension as a function of drop shape and gravity. The technique provides information on the relative surface activity of food ingredients, the physical nature of the stabilising layer on droplets and the rehydration properties of food powders.

**High Speed Camera (HSC)** technology is used to characterize events, which happen too fast for traditional film speeds. It is a device capable of capturing moving images at rates in excess of 3000 frames per second. Work in Teagasc has used HSC in combination with light microscopy for real-time, frame-by-frame analysis of milk powder particles during rehydration. Other applications include analysis of atomisation behaviour and rapid formation of powder particles during spray-drying.

**The 3D ‘Foodini’ Printer** is capable of printing any food material able to pass through a 0.4 cm nozzle and can print up to 5 different ingredients at once. Concentration, viscosity, flow behaviour and ingredient interactions all contribute to food structure and behaviour during 3D printing. To date, a wide range of food materials has been successfully printed including icing, hummus, pureed vegetables and meat.

**In vitro Digestion of Food** – with the development of foods for health, there is a need to understand how food and its components are digested. The transit in the upper gastro-intestinal tract can be simulated in the laboratory using an internationally recognised static digestion method. Teagasc has developed a platform to digest food in vitro and in vivo and assess if/when individual components are bioaccessible and available to the body. The new, semi-dynamic in vitro digestion method seen here was developed recently to monitor the mechanisms and kinetics of protein digestion.
**Department of Agriculture, Food and the Marine**

**Research Division**

The Department of Agriculture, Food and the Marine’s (DAFM) mission is to lead the sustainable development of the agri-food, forestry and marine sectors and to participate in the sustainable development of the circular bioeconomy sector. The Department, its staff and State Agencies, play a vital leadership role in providing and encouraging an environment which can deliver on this mission and on the strategic objectives set out for the agri-food sector in FoodWise 2025. The strategy is complimented by the Strategic Research Agendas for the Agri-food, Forestry and Marine sectors, namely SHARP – “Sustainable Healthy Agri Food Research Plan”, FORI – “Forest Research Ireland”, and ’HOOW - “Harvesting Our Oceans Wealth’ which set out the research and innovation priorities and objectives as agreed by all relevant stakeholders.

In pursuit of this, DAFM funds collaborative, national pre-competitive type research projects across the agri-food spectrum under its three competitive research funding programmes namely FIRM, Stimulus and CoFoRD. DAFM also uses these competitive funding programmes to enable Irish researchers participate in transnationally conducted research under programmes such as European Research Area Networks (ERA-NETS), Joint Programming Initiatives (JPI’s), European Joint Programmes (EJP’s), and the US-Ireland R&D Partnership.

DAFM also promotes and supports participation in the Societal Challenge 2 and the Biobased Industries Joint Undertaking elements of the EU Horizon 2020 Framework Programme on research and innovation relating to agriculture, food, forestry, marine and the bioeconomy.

**Enterprise Ireland**

**Presenter: Martin Fleming**

Enterprise Ireland is the government organisation responsible for the development and growth of Irish enterprises in world markets. In this way, we support sustainable economic growth, regional development and secure employment. We have over 30 international locations facilitating access to more than 60 countries worldwide and all of our services are geared toward helping Irish companies build an international business. We work in partnership with Irish food entrepreneurs and food companies to help them to develop an export-led business, expand, innovate, become more competitive and develop their management capability so they are well placed to win export sales on global markets and in turn create new jobs in Ireland. Enterprise Ireland will present a number of supports available to companies to develop their business, including collaborative R&D with Teagasc and third-level institutes.