

Small Molecule Biotechnology

Interest in engineering biomolecules for the pharmaceutical industry is rapidly increasing, for example in novel therapeutics. Additionally, understanding how food components and nutraceuticals interact with cellular biomolecules can help us understand diseases better.

Dr Barry Ryan

Professor Gary Henehan and Dr Barry Ryan. This research focuses on the application of protein chemistry, enzymology and molecular biology in a variety of biomedical and biotechnological applications. Current research is focused on understanding the regulation of the voltage gated shaker potassium channel. The beta subunit of this channel is involved in moderating potassium ion flux. This channel has been shown to be important in a number of convulsive disorders such as epilepsy.

Dr Jesus Frias, Professor Hugh J. Byrne, Dr Sinead Ryan (UCD) and Professor David Brayden (UCD). Formulation of nanoparticles for a milk peptide. IPP is a peptide from milk exhibiting anti-hypertensive effects. Bioavailability is limited due to poor permeability across the intestine. Frias and Byrne are interested in nanoparticle formulation for the oral delivery of food peptides with low permeability through the intestinal membrane. This project is funded by FIRM.



Dietetics, Human health and nutrition

This area of research focuses on a number of factors involved in public health and nutrition with the aim of promoting healthy eating and associated lifestyle behaviours. Specific areas of research include obesity, Infant feeding, status and evidence based solutions at demographic level and diet and eye health.

Dr Clare Corish and Dr John Kearney. Managing Food on Shift Work. Sponsored by safefood and in collaboration with Professor Barbara Livingstone in the University of Ulster, the 'Managing Food on Shift Work' project aims to investigate the barriers and facilitators to healthy eating and associated lifestyle behaviours among Irish shift workers, the results of which will form the basis on which national recommendations will be made.

Dr John Kearney and Dr Daniel McCartney. Diet during pregnancy and infant feeding. Dr Kearney and Dr McCartney are involved with studies into maternal diet during pregnancy and infant feeding. There is an increasing recognition of the critical role which maternal diet plays in determining offspring's lifelong risk of chronic diseases such as obesity, diabetes, high blood pressure, cardiovascular diseases, certain cancers and osteoporosis. These disorders all occur with high frequency in the Irish population, and there is now evidence that poor maternal diet may be instrumental in these high disease rates, especially among lower socioeconomic groups.



Further project details available on our website: www.dit.ie/eshi

Food & Health Research Centre



The Food Health Research Centre (FHRC) represents one of the strategic research priority areas in the Environmental Sustainability and Health Institute (ESHI). By bringing together researchers working on programmes that range from food safety, nutraceuticals, food technology, to human nutrition and dietetics, the Centre offers a holistic approach to food and health research.

With a strong record of collaboration with industry partners and government agencies, FHRC is contributing to government initiatives. Working under the ESHI umbrella, the work of the Centre responds to the national and European research agendas (e.g. Harvest 2020; Horizon 2020). Health and sustainability of food systems are key issues requiring the involvement of a wide range of stakeholders; the application of innovative solutions; and education of producers and consumers.



Figure 1: Primary research areas in the Food and Health Research Centre

The FHRC involves collaborative research between food safety, nutraceuticals, food technology in addition to dietetics and nutrition, providing a unique area of connection between food, nutrition and health in both the community and clinical setting.



Further Information

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Featured Research Projects

Nutraceuticals and Functional Foods

A nutraceutical is any substance that is a food or a part of a food and provides medical or health benefits.

Professor Nissreen Abu-Ghannam. Bioprocessing Technologies. Professor Nissreen Abu-Ghannam's research area focuses on applying and optimizing bioprocessing technologies to maximize the extraction of high-added value ingredients for pharmaceutical and nutraceutical applications using the waste streams of the Irish agri-food industry and underutilized marine resources such as seaweeds. Professor Abu-Ghannam's research is directed towards the development of sustainable and environmentally friendly methods, characterised as being Green, with potential to enhance bioactives extraction yield, reduce toxic waste material, environmental impact and time and energy consumption. Processing innovations will be vital in ensuring the ongoing competitiveness of the Irish food industry.

Dr Jesus Frias, and Professor Hugh J. Byrne, Dr Sinead Ryan (UCD) and Professor David Brayden (UCD). Improved delivery of natural selenium from the cultivated mushroom (*Agaricus bisporus*). Improved delivery of natural selenium from the cultivated mushroom (*Agaricus bisporus*). The proposal uses a "smart" economy approach to a strategic sector of the Irish food industry by exploiting "spilling-over" Irish-based research know-how from the pharmaceutical drug delivery area to make oral nutraceutical formulations of natural selenium (Se) derived from mushrooms. The aim of this project is to isolate and purify mushroom Selenium by-products for formulation in oral nano-enabled drug delivery technologies in order to improve bioactivity and reduce toxicity.



Post-harvest and Non-Thermal technologies

Dr PJ Cullen and Dr Paula Bourke. In-package cold plasma technology: Plasma diagnostics and food quality studies. Electrical and optical characterisation of the non-thermal plasma source is essential prior to translating this technology to industrial applications. This project includes diagnostic studies using capacitance-voltage studies and emission/absorption spectroscopy. The work focuses on aspects of food quality following cold plasma treatment and the physical and chemical characterisation of the plasma using fresh produce. Also, the opportunities and challenges associated with in-package cold plasma technology are being investigated.

Dr PJ Cullen and Dr Paula Bourke. Utilisation of in-package cold plasma technology for food safety control. Atmospheric cold plasma inactivates in-package microorganisms. The inactivation efficacy is associated with process and system parameters, including treatment time, post-treatment storage time and mode of exposure. Both the treatment time and post-treatment storage time have been proven to sterilize bacterial suspensions and food products. The mechanism of this anti-microbial effect is associated with the generation of reactive species. Different parameters are investigated to vary the type and amount of reactive species, which results in different inactivation efficacies. The damage patterns differ between microbial species with different cell structures offering insights into the mechanism of action and how the technology can be enhanced for a range of food safety issues.



Food Product Development and Culinary Innovation

Dr Catherine Barry-Ryan. Mushroom flavour profile. Customers are key to Monaghan Mushrooms. Dr Barry Ryan's desire is to fully understand why the customers like or dislike the flavour of mushrooms? Correlation of instrumental and sensory analysis of cultivated and specialty mushrooms would provide Monaghan Mushrooms with data that would enable them in the future to improve mushroom strain selections with flavour compounds that the customer wants.



Dr Roisin Burke. Development of innovative food and drink products. Dr. Burke's research focuses on using Molecular Gastronomy and its applications to develop innovative food and drink products. The chemistry and physics of culinary transformations are examined e.g. to improve flavour release in emulsion based recipes. An application of Molecular Gastronomy, 'note-by-note cooking', is being used to create novel foods. Dishes are made using pure compounds instead of using animal or plant products.



Food safety and diagnostic tools for food and pharmaceutical industry

Dr David O'Connor. Improving beef quality for consumers. Dr O'Connor, in collaboration with Teagasc at the Ashtown Food Research centre, is working on a project designed to improve and add value to the quality of beef products for retail cuts. This research project utilises gases mixtures in the package and pre-treatments to preserve the "healthy" red colour of oxygenated meat.



Dr Carl Sullivan and Dr P.J. Cullen. The Meatsense Project will develop spectral based systems to predict meat quality and ensure product safety. A prototype area scanning NIR Hyperspectral Imaging (HSI) system will be developed and assessed for detailed meat inspection. Additional devices will be used to monitor meat products; major beef constituents (e.g. moisture, protein and fat), physical properties (pH, colour, water holding capacity, and slice shear force) and consumer assessed eating quality (odour, flavour, juiciness and tenderness).

Dr P.J. Cullen. Opticlean project as a cleaning validation technique. Pharmaceutical cleaning validation techniques are laborious, time consuming and expensive. The aim of the Dr Cullen's OPTICLEAN project was to produce an effective portable optical system for cleaning verification in the pharmaceutical industry. Research focused on developing a portable imaging device that would provide accurate information in real-time, facilitating the development of a technology to be trialled in the pharmaceutical industry as a cleaning validation tool.

Dr Jesus Frias, Dr Maria-Jose Gallagher (UCC) and Dr Jorge Oliveira (UCC). Development of risk assessment tools of package/product systems for a safe and sustainable food chain. This project, funded by Food Institutional Research Measure (FIRM), aims to develop a risk assessment tool for fresh produce in cold supply chain. They aim to develop a simulation software with a user friendly interface which will be used by food manufacturers, retailers and regulators to ensure quality and safety for the consumer.