Food
Programme

Technology

Portfolio

Technology for the Food Industry



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Food Innovation Gateways

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Teagasc, as the national agriculture and food development authority, has the responsibility of supporting innovation for food companies. Our Food Technology and Knowledge Transfer Strategy describes how we will enable food companies to engage with us in various ways to support their own food innovation plans. Developing partnerships and collaborations with industry is central to our strategy.

This Portfolio of Technologies is a tool that allows us to communicate to the food industry, and wider stakeholders, details of Teagasc technology offers, emerging technology opportunities, technical services, pilot plant facilities and key contact points. It will enable the reader to understand the depth and breadth of our food research and development capabilities within the Teagasc Food Programme.

The Portfolio is to be used as a starting point (or menu) from which food companies can begin to engage with us through various innovation support channels. It will be updated regularly.

Contact details of the key Teagasc specialists are given on each page. Feel free to engage with these personnel directly and/or contact our Technology Transfer Office staff at:

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Declan J. Troy
Assistant Director of Research and
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Portfolio

Technology for the Food Industry

Offers

Summaries of available technology, owned or part-owned by Teagasc, that are currently open to potential users.

Updates

Main findings from Teagasc food research projects focusing on key technologies at various stages of development.

Expertise

Concise overviews of our high specification technical equipment and pilot plant facilities.

Services

Our main technical and specialist food services offered to the industry.

Profiles

Profiles of our staff detailing their expertise and highlighting the role they can play in providing solutions and/or opportunities for food companies.

Technology

Offers

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Toddler Milk

Teagasc and University College Cork (UCC) researchers have developed a method for production of a low-protein milk product, in reduced and full-fat formats, based on adaptation of cow's milk to meet toddlers' nutritional needs but usable by the whole family. We are seeking a commercial partner within the infant nutrition/dairy industry to optimise and commercially exploit this technology.

Summary

Levels of childhood obesity continue to increase as part of the European obesity epidemic. Toddlers in the Western World typically have a far greater intake of protein than they need, and studies have shown a significant association between high protein intake in early childhood and a later risk of obesity.

To address potential issues for toddlers with high protein intake, Teagasc/UCC researchers, in collaboration with key opinion leaders in the infant nutrition space, have developed a process that adapts cow's milk to meet such toddlers' nutritional needs, but which can also cater for the whole family.

Problem Addressed

Dairy products play an important role in toddler nutrition and are by far the lowest cost source of dietary calcium and riboflavin. However, studies have shown that infants in the Western World have an average protein intake of approximately 2.5g/kg of body weight/day, which exceeds the recommended intake of 1–1.5g/kg of body weight/day. Documented observational data increasingly indicates a link between high protein intake during early childhood and a risk of obesity in later life. Many such toddlers are fed formulated toddler milk with altered nutritional and taste profile when compared to natural milk, and at a premium cost to consumers. To date there has been an absence of natural milk product alternatives in this growing and premium toddler market, which this technology aims to address.

Solution

This invention relates to a process enabling the production of a novel natural reduced-fat, or full-fat, low-protein dairy product from cow's milk, which has been tailored to meet a toddler's typical nutritional needs. As the product is based on cow's milk, it has a superior taste that is much closer to natural cow's milk than competing formulated toddler milk. Hence this novel product should represent an opportunity for the producer, purchaser and end-user to benefit from such an innovation.

Competitive Advantage of Technology

1. Through the application of mild processing technologies, a natural low-protein alternative to cow's milk tailored to the nutritional profile of toddlers' needs, but without altering the great taste of cow's milk is possible.
2. As this toddler milk, which is producible as both full-fat and reduced-fat products, tastes just like regular cow's milk, it can be consumed by the whole family.
3. This resulting milk product can be produced in fresh, Ultra-High Temperature (UHT) and powder formats, and is easily scalable.
4. This product is suitable as a carrier for fortification of other nutrients not naturally abundant in milk, but often lacking in toddlers' diets, for example iron.

Stage of Development

A prototype has been developed to a pre-commercial scale, with positive consumer feedback on taste. Available in fresh, UHT and powder formats.

Opportunity

Teagasc, as lead, wish to partner with a company in the infant nutrition and/or dairy industry in optimising and commercialising this process and resulting product, through a collaborative/licensing arrangement.

Intellectual Property Status

A patent application was filed by Teagasc and UCC in 2015, claiming a novel dairy product, based on cow's milk, suitable as a substitute milk for a toddler.

Funding

Food for Health Ireland (Enterprise Ireland)

How to Proceed

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Rapid Detection of Toxin-Encoding *Bacillus Cereus*

Teagasc is seeking partners within the diagnostics industry to exploit a novel qPCR-based test capable of rapid, simultaneous detection of all *Bacillus cereus* toxin encoding genes ("CereusToxTest"), of benefit to the food industry.

Summary

Teagasc researchers have developed a novel q-PCR based assay capable of rapid, simultaneous detection of all *Bacillus cereus* toxin encoding genes. This assay offers significant advantages in time and specificity compared to what is currently commercially available.

Value Proposition

Rapid and reliable detection of this target species is necessary to identify B.cereus-contaminated food and thereby reduce/prevent such food poisoning outbreaks in consumers, and lessen economic losses and reputational damage to food producers, caused by such recalls and/or outbreaks.

Bacillus cereus is a pathogenic, spore-forming soil-dwelling bacterium that is commonly encountered in raw milk and subsequent dairy products. It is resistant to industrial pasteurisation processes due to the presence of endospores and is therefore a major concern for the dairy industry. The various strains of B.cereus produce several potentially pathogenic substances, linked to foodborne emetic and diarrhoeal syndromes and are known causative agents of food poisoning for over forty years. The emetic syndrome is caused by cereulide, (synthesised by a non-ribosomal peptide synthetase encoded by the ces gene), while the diarrhoeal syndrome is caused by at least three known heat-labile enterotoxins.

No commercially available kits (immunoassays or molecular kits) are capable of simultaneously detecting the 4 toxins produced. Existing assays either detect only a subset of toxins or do not reliably distinguish between B.cereus and closely related, harmless bacteria, leading to false negatives and positives, which this assay circumvents.

Solution

CereusToxTest is a probe-based qPCR approach to simultaneously detect and quantify levels of each of the 4 toxin gene types. It is a multiplex assay based on bespoke fluorophore-labelled probes, whereby detection and quantification of the 4 toxins is possible in a 2 –hour real-time PCR run.

Competitive Advantage of Technology

- Addresses the issues associated with the non-specificity (leading to false positives) or excessive specificity (detection of a subset of toxins only, leading to false negatives) of other tests.
- More rapid than existing assays and avoids the need for downstream analysis, such as melting curve analysis and monitoring of PCR replicon size.
- Offers simultaneous detection and quantification of all 4-toxin encoding gene types in a high throughput single assay. Toxin profiling may allow for more informed treatment options.

Status/Development Stage

Fully functional multiplex real-time PCR assay, available through licensing of know-how.

Fields of Application

Development of kits for molecular biology/DNA-based diagnostics for testing of food production and processing environments, raw materials, foods and food ingredients to ensure food safety.

Funding

WP Walsh Fellowships Programme

Irish Dairy Board

How to Proceed

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Detection of Cause of Pink Discolouration Effect in Cheeses

Teagasc is seeking partners within the diagnostics industry to exploit a novel qPCR-based test for supply of assay/kit for detection of the bacterial cause of pinking discolouration defect, to the dairy and cheese industry.

Summary

Teagasc researchers have developed a novel q-PCR based test capable of detecting the bacterial cause of pinking discolouration defect in the dairy and cheese industry for the first time. This technology helps to solve a significant problem for the global dairy industry and will be of interest to the diagnostics industry.

Value Proposition

Pinking discolouration defect, primarily in cheese, is a global problem for dairy producers. Such pinking defect, which can manifest itself in various forms, on block surfaces or below the surface, can lead to downgrading or rejection of cheeses, and hence significant economic losses to the producer. To date, the cause of the defect has been unknown, but subject to much debate. By understanding and being able to identify the cause and origin of such a defect, this would facilitate removal/ treatment of the cause at the source, thereby significantly reducing the occurrence of costly pinking defect discolouration events and increasing efficiencies and quality of cheese manufacturing plants. This hasn't been possible to date, as the cause of such discolouration defect remained unknown.

Technology & Opportunity

By discovering the source of pink discolouration to be bacteria not associated with cheese production, and developing an assay to identify sources of such defect through identification of the causing bacteria, this invention provides a method of assaying cheese manufacturing plants, at ingredients and cheese processing plants level to identify the source of the pinking defect. Such testing of cheese systems, for the risk of pinking in cheese, will allow timely treatment of either ingredient or machinery/plant surfaces to eliminate the bacteria, before the defect arises, thereby minimizing/ avoiding the occurrence of such pinking discolouration defects at commercial scale.

Competitive Advantage of Technology

- A novel method of determining presence in cheese sample of source of pink discolouration defect.
- A method of testing a cheese manufacturing system for a risk of pinking discolouration, allowing modification of system to remove/ treat the origin of the defect.
- Resulting qPCR assay, and/or a kit comprising a diagnostic reagent, to detect the source.

Opportunity

This technology would be a valuable addition to laboratories providing diagnostic solutions to dairy industry to develop kits/assay based on this invention, and is available to licence.

Intellectual Property Status

A patent application was filed in 2014, (UK Application No. 1410948.2), claiming a method to determine the presence of such a source, due to the presence of the novel bacteria.

Funding

icos

WP Walsh Fellowships Programme

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Highly Efficient Protein Recovery from Food By-products

Teagasc is seeking commercial partners within various food processing industries to exploit a novel technology for extracting proteins from solid by-products or waste from food (fish, meat, poultry), with over 95% protein recovery, based on improved sequential isoelectric solubilisation.

Summary

Teagasc researchers have developed a highly efficient protein recovery technology from food by-products with greater than 95% protein recovery. This technology is ready for scale-up and Teagasc is seeking companies to exploit this novel technology.

Value Proposition

This technology addresses the issue that almost 50% of the total weight of fish is considered a waste or a low-value product, composed mainly of heads, internal organs, tail, fins, frames and skin. Protein content and amino acid profile in these by-products are similar to that in fillets hence there is a significant amount of high quality protein currently not harnessed. As most by-products from fish processing are used in composting, pet food or animal feed, so provide a very low value-add, there is a desire to generate alternatives with a higher value-add. This represents an opportunity to such industries to significantly increase total protein recovery from such waste, with significant costs implications, through increased profits through generation of protein-based added-value products.

This novel technique, allows solubilisation of more than 95% of total proteins, a significant improvement compared to the previous 65% reported. Furthermore, reagent consumption is not increased despite the additional step of extraction, and no expensive equipment investment is required, since regular equipment are employed in the process (tanks, centrifuges, blenders, stirring and pH probes), rendering this easily transferable to industry.

Technology

This invention is based on a substantial modification of isoelectric precipitation-solubilisation (ISP) methodology, whereby protein from by-products are extracted in alkaline conditions and the remaining insoluble proteins are subsequently extracted under acidic conditions. Finally, both solutions are mixed to reach a pH close to 5.5 where all proteins precipitate and thus can be easily recovered by centrifugation or filtration. The process yields purified protein and a precipitate formed by scales and bones.

Competitive Advantage of Technology

- 95% of total proteins extracted from fish by-products, significant improvement from 65% previously.
- No expensive equipment required, or increased reagent consumption.
- Should be easily scalable and transferable to industry, and can be combined with other extraction processes.

Fields of Application

Although specifically developed using fish by-products, this could be applied to solid by-products or meat processing and poultry wastes and is ready for scale-up.

Intellectual Property Status

An EPO patent application was filed by Teagasc (July 2015), claiming a novel method of sequential isoelectric solubilisation of animal by-products.

Funding

NutraMara

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

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LABocol: Cholesterol Lowering Probiotic Yoghurt

Teagasc and UCC researchers have developed an invention which allows a novel Lactic acid bacterial (LAB) strain, Lactobacillus mucosae, to be used in a nutritional approach to lowering cholesterol, e.g. in a probiotic yoghurt. Teagasc and UCC seek a commercial partner in the functional food space to further develop this technology with a view to commercialisation and further validation of the supporting health claims.

Summary

Globally, a third of ischemic heart disease is attributable to high cholesterol, with raised cholesterol estimated to cause 2.6 million deaths annually.

Teagasc and UCC researchers have produced scientific data showing that a novel probiotic yoghurt containing novel exopolysaccharide (EPS) producing *Lactobacillus mucosae* DPC6426 can lower blood cholesterol, a risk factor in the development of coronary heart disease, by 53% in 12 weeks.

Problem Addressed

The invention broadly relates to a LAB strain that has been found to express an EPS and confers cardio-protective properties when consumed. It provides for the use of DPC 6426 as a possible nutritional approach to lowering cholesterol.

LAB strains are widely added as starter cultures in the dairy industry and have a long history of safe use. The presence of EPS in dairy products improves texture, decreases the risk of syneresis (whey separation) and improves the techno-functional properties of the products. It has been suggested that EPS produced by LAB interacts with cholesterol in a manner like dietary fibre.

Significantly increased cholesterol excretion was found for the probiotic yoghurt fed group.

Competitive Advantage of Technology

1. LAB are generally regarded as safe (GRAS) according to the FDA.
2. In-situ production of EPS throughout storage resulted in higher quality yoghurt with improved textural and rheological qualities compared to other yoghurts.
3. Blood cholesterol reduced by 53% in 12 weeks.

Opportunity

There is an opportunity to partner with Teagasc/UCC in developing and commercialising a cholesterol lowering probiotic yoghurt, including:

- Establishing the efficacy of the cholesterol lowering properties and effects on plaque stability of the probiotic in animal studies.
- Determining the mechanism of action and benchmarking against plant sterol esters and oat beta-glucan.
- Conducting a human intervention trial to compile a dossier to support a health claim application.

Intellectual Property Status

A patent application was filed by Teagasc and UCC in 2012.

Partners

UCC
Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

Funding

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

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Whey-less Cheese Manufacture Based on Novel Cheese Technology Platform (NCTP)

Teagasc is seeking industrial partners within the ingredient and retail cheese industry to assist in refinement of NCTP for innovative cheese ingredient solutions and health cheeses tailored to specific customer requirements.

Summary

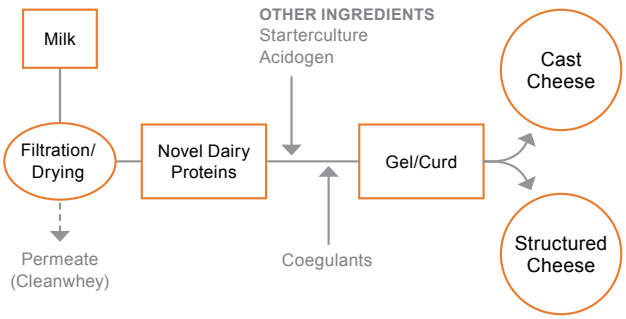
The rapidly growing market for ingredient cheese is currently being served by sourcing traditionally-manufactured table cheeses. Teagasc has developed a dedicated 2-step process for direct manufacture of ingredient cheese tailored to customer requirements. Without the need for whey expulsion it lends itself to the development of new generation health cheeses and increased control of cheese characteristics.

Problem Addressed

Conventional manufacture of natural cheese is quite limited in terms of cost-competitive, customised ingredient solutions, reliance on a source of fresh milk and a large volume of 'unclean' whey, i.e. loss of added materials (e.g., prebiotic materials). Until now, it has not been possible, due to technological constraints and functional limitations, to reconstitute available dairy ingredients in the concentrated form that corresponds to the final compositional specification of targeted cheese types, thereby allowing increased control of ingredient cheese solutions.

Solution

This NCTP provides a platform for design and manufacture of cheeses with varying dry matter content and customised properties using three basic steps. The concept relies on customising the functionality of a milk protein-based ingredient and its subsequent transformation into cheese according to demand. Resultant cheeses may be either cast cheese (<48% dry matter, DM) formed by rennet/acid treatment of re-assembled milk in final package and/or structured cheese (up-to 60% DM) formed by further curd treatment (see figure below).



Competitive Advantage of Technology

1. NCTP capable of making cheese without fresh milk source.
2. No (or very limited) whey expulsion (cast cheeses)
3. Complete retention of any added materials, with potential for development of new generation health cheeses.
4. Greater opportunity to design/control cheese characteristics of ingredient cheeses.

Opportunity

This technology allows the development of a novel range of prototype, functional, casein-based ingredients whereby the pH, buffering capacity and casein-to-whey protein ratio of the resultant cheese can be targeted.

The aim is to link up with relevant cheese ingredient manufacturers to prepare and evaluate prototype cheeses (at moisture levels > 53% with functionality suitable for ingredient cheese applications) with a view to licensing this technology.

Intellectual Property Status

PCT patent Application WO 2009/1 50183.

Funding

ENTERPRISE IRELAND

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Probiotic Cocktail as Animal Feed Additive ("Live5")

Teagasc and UCC researchers are seeking a commercial partner within the animal feeds industry to exploit a new technology. Based on a natural probiotic mix, for growth and good health promotion in animals (specifically pigs), the objective is to develop stable and commercially relevant probiotic product prototypes ready for market.

Summary

The microbial feed additive (or direct-fed microbial), is based on a five strain mix "Live5". It is a natural probiotic mix that can be used as an alternative to chemicals and antibiotics in pig husbandry, both as a means of controlling pathogen carriage and improving growth rate and feed conversion. The five live beneficial bacteria help maintain a healthy intestinal balance for optimum animal performance.

Problem Addressed

Antibiotic growth promoters are currently being phased out of use because they impose a selection pressure for bacteria that are resistant to antibiotics. There is a need for alternative solutions that do not depend on antibiotic usage.

Subclinical salmonellosis is a relatively common problem in pigs, usually causing no obvious animal health problems. Affected pigs are carriers of *Salmonella*, and can excrete large numbers of *Salmonella* organisms intermittently, and particularly when stressed. *Salmonella* in pigmeat has long been associated with outbreaks of foodborne illness.

Solution

The mixture (*Lactobacillus murinus* DPC6002 and DPC6003, *Lactobacillus pentosus* DPC6004, *Lactobacillus salivarius* DPC6005 and *Pediococcus pentosaceus* DPC6006) has been shown to be effective in reducing *Salmonella* shedding in pigs, in protecting against the clinical signs associated with *Salmonella* infection, and in improving growth rates. Live5 has also demonstrated the potential to modulate host immunity in pigs.

Competitive Advantage of Technology

Live5 offers huge potential for use in pig production; in enhancing health status, reduction of subclinical carriage of pathogens (gram negative *Salmonella* and *E.coli* in particular) and in acting as an alternative to antibiotic therapy. Furthermore, one of the Live5 microbes, *L. salivarius* DPC6005, produces a heat stable, two-component bacteriocin, Salivaricin P, which is highly active against a number of gram positive bacteria, including *Enterococcus* sp. and *Listeria innocua.*

Opportunity

It is in the interests of both industry and consumers to reduce the significance of *Salmonella Typhimurium* as a pigmeat-associated food borne pathogen.

The potential fields of applications in animal health include:

- Microbial animal feed additive.
- Alternative to antibiotic growth promoters.
- Therapeutic application.

Intellectual Property Status

A patent application was filed by Teagasc and UCC and the patent "Probiotic composition suitable for animals" was recently granted in the US and Europe.

Partners

UCC
Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

Funding

ENTERPRISE IRELAND

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

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Enhanced Derivatives of Nisin

Teagasc and UCC are seeking commercial partners within the food and pharmaceutical industries to further develop and commercialise superior derivatives of nisin bacteriocins, for applications in the food areas of bio-preservation and medical devices.

Summary

Teagasc and UCC have developed foodgrade derivatives of nisin A, and producers thereof, with greatly enhanced antimicrobial activity. This offers potential in a greater range of food products and other products within medical/ medical device areas, when compared to commercial nisin A.

Problem Addressed

Nisin A is an antimicrobial peptide which is used as a natural food biopreservative in over 50 countries. Nisin and nisin-producing foodgrade *Lactococci* are extensively used in food nisin is the only peptide to have been added to the European food additive list (E234) and approved by the US Food and Drug Agency (FDA) and World Health Organisation. Despite its success, its application is limited in some instances due to its relative inactivity against particular target species and strains and/or its poor activity at non-acidic pHs.

Solution

Recently developed foodgrade derivatives of nisin and its producers have been found to display greatly enhanced antimicrobial activity against problematic pathogenic and spoilage microbes. They are also active at non-acidic pHs and are effective not only against a broader range of gram positive bacteria but also some gram negative bacteria. With the added benefit of being effective at non-acidic pH, this ingredient has the potential to be applied in a greater range of food products. The availability of enhanced forms of nisin could result in the replacement of nisin A and make other applications a reality.

Competitive Advantage of Technology

1. Enhanced antimicrobial activity.
2. Active at non-acidic pHs.
3. Extended applications of nisin.

Opportunity

This technology would be of interest to companies in the fields of food biopreservatives and medical devices and it is currently being evaluated by a company in the animal health field. Companies are invited to discuss this technology with a view to further development in the following areas:

- Demonstration of safety of variants.
- Demonstration of shelflife extension properties.
- Development of foodgrade applications.
- Scale-up manufacturing.

Intellectual Property Status

Patent applications on the various nisin derivatives have been filed by Teagasc and UCC.

Partners

UCC
Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

Funding

ENTERPRISE IRELAND

SFI Science Foundation Ireland

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Probiotic-Based Treatment of Mastitis

Teagasc and University College Cork researchers are seeking a commercial partner within the animal health industry to exploit a novel technology involving the treatment of bovine mastitis with foodgrade probiotic bacteria – a natural and effective alternative to antibiotic therapy.

Summary

This technology represents a biological approach to mastitis prevention and is based on live foodgrade cultures of probiotic bacteria, specifically a proprietary strain of *Lactococcus lactis*, effective in treating animal and human infectious diseases and proven to be at least as effective as antibiotics, in the treatment of mastitis.

Problem Addressed

Current treatments for mastitis rely heavily on antibiotics, both for prophylaxis and therapy. This strategy is costly and frequently ineffective. Additionally there are concerns regarding the overuse of antibiotics in veterinary medicine, as it may contribute to the increased spread of antibiotic resistance to human and animal pathogens. Recent legislation in the EU curtailing the use of antibiotics in animal feed should lead to greater controls and limitations in their use. Use of antibiotics may be limited to situations where they are deemed critical.

Solution

There are several advantages to this treatment regime. The bacterium can be produced cheaply in large quantities and it is a foodgrade organism with GRAS status and hence should not require significant with-holding periods for the milk produced by recovering animals, as in the case of treatment with antibiotics.

Competitive Advantage of Technology

1. Natural, effective alternative to antibiotic therapy for treatment of both mild and severe mastitis. Effective against mastitis caused by gram positive and negative bacteria.
2. Using live preparation, cure rates of subclinical and clinical infections were comparable to standard antibiotic therapy
3. Based on use of a foodgrade organism, significant withholding periods should not be required for milk produced by recovering animals, thereby reducing milk losses.
4. Could improve milk quality from clinically infected quarters.

Opportunity

Mastitis causes significant economic losses to the dairy industry. Economic loss in Ireland is estimated at €189.56 per cow, in severe cases, and €45.31 in mild cases. Taking the average incidence of mastitis as 25%, a mean economic value per case of mastitis of €71.84 is estimated (EBI 2007). With an Irish dairy herd population of 1.1m, this gives an estimated annual cost of €20m in Ireland alone.

This represents a significant opportunity for an animal health company to validate and commercialise this technology.

Intellectual Property Status

Patent granted in US and in selected European countries, “Use of Probiotic bacteria in treatment of infection”.

Partners

UCC
Coláiste na hOllscoile Corcaigh, Éire
University College Cork, Ireland

Funding

Department of Agriculture, Food and the Marine
An Roinn Talmhaíochta, Bia agus Mara

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UPDATE

A Food Matrix Approach to Meat Product Development

Key External Stakeholders

Primary meat processors; Ingredients companies; SMEs; Regulatory agencies: DAFM

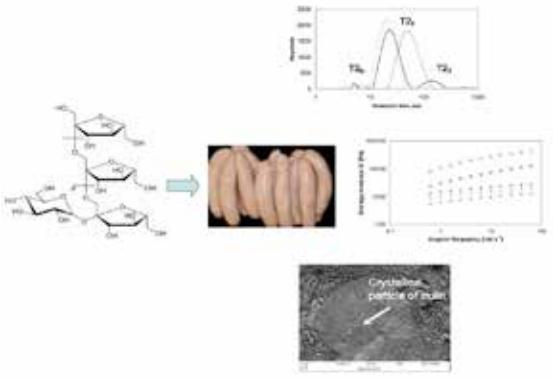
Practical Implications for Stakeholders

Processed meat products represent complex systems that can be considered as a 'matrix' of interacting components.

Increasing consumer awareness of health issues associated with high dietary intake are driving the need for change in the products available to them. Therefore, the meat industry is examining the possibilities of meat products with reduced fat salt and additives as well as meat-based functional foods as an opportunity to improve its public image and update dietary goals.

However, the removal of traditionally used ingredients with the goal of improving health and well-being, e.g. fat and salt, in processed meat products represents a significant technical challenge.

This is due to the fundamental role they play in the structure or the formation of effective gels, allowing



them to function as cohesive meat products.

By improving our understanding of the impact of interactions between the food matrix and novel ingredients on technological and sensory performance, we are developing strategies to optimise healthier versions of traditional meat products such as reduced fat and salt products and products including bioactive compounds and prebiotic fibres.

Main Results

- Comminuted products (burgers, breakfast sausages, and frankfurters) formulations were optimised using consumer sensory panels and instrumental measurements with regards to salt and fat levels that represented a significant decrease in their respective contents compared to their retail counterparts (controls).
- Using advanced experimental design software, both comminuted and whole muscle products formulations containing functional ingredients, such as fibre, prebiotics, omega-3 fish oils and antioxidants were optimised.
- Detailed ultra-structural analyses better elucidated the underlying forces governing overall product quality, the knowledge of which can be used in a more systematic scientific approach to new product development.

Opportunity/Benefit

A series of templates available to industry that can be used in future to predict the effects of alteration of various parameters on microstructure, molecular interactions and their relationship with product quality.

Collaborating Institutions

University College Cork,

Project Number: 5957

Funding Source: DAFM (08/RD/TAFRC/671)

Date: May, 2014

Project Dates: Dec 2008 – May 2014

How to Proceed

For further information access the full Technology Update at:
www.teagasc.ie/publications

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UPDATE

Advanced Systems for the Rapid Detection of Anti-Parasitic Drugs in Food

Key External Stakeholders

Dairy, beef and sheep farmers, primary meat and milk processors, regulatory agencies (DAFF, FSAI, IMB).

Practical Implications for Stakeholders

Excellent progress has been made in the development of screening assays for drug residues in food. Immunochemical screening assays were developed in this project as a rapid low cost means of detecting benzimidazole residues in food, as an alternative to chemical assays. A number of assays were successfully validated. A biochip array assay was successfully developed to detect four different drug classes and shows good potential for application in specialist laboratories or at an industry level.

The milk industry is the only industry likely to apply this technology because they are the only industry that carries out monitoring at factory level. However, the scope of the assays needs to be extended to key flukicide residues (nitroxynil, closantel, rafoxanide, clorsulon and triclabendazole) to meet industry demands if they are to be used.

With benzimidazole drugs widely used in the treatment of worm and fluke infections in food producing animals, these novel immunochemical assays are proposed as an alternative low cost means of detecting benzimidazole residues in food. These assays are applicable in specialised laboratories or at a factory level to prevent contaminated produce entering the food chain.

Main Results

- Three working immunobiosensor assays were developed and validated to detect 17 benzimidazole residues in milk and meat.
- A novel multiplex immunoassay was developed for detecting benzimidazole and macrocyclic lactone residues in fruit juice.
- The new technologies developed were validated to meet EC 2002/657 criteria.
- These represent a rapid, low-cost, effective means of screening drug residues, and a viable alternative to chemical assays, applicable in specialised laboratories or at factory level.

Opportunity/Benefit

Teagasc can be at the forefront of engaging with food producers relating to such low-cost screening techniques, through our extensive expertise in the field.

Collaborating Institutions

Dublin City University

Project Number: 5556

Funding Source: DAFF (05/R&D/TN/355)

Date: January, 2011

Project Dates: Sep 2006 – Aug 2010

How to Proceed

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UPDATE

Aerial Contamination in Beef, Pork and Lamb Abattoirs

Key Stakeholders

Beef, pork and lamb processors, scientists, regulatory personnel, EFSA

Practical Implications for Stakeholders

The relationship between the quantity of bacterial contamination in the air and that deposited on meat carcasses had not previously been established. This project focused on beef, lamb and pork abattoirs in Ireland and showed that there was no measurable relationship between aerial and carcass contamination. However the results clearly demonstrated that the air in these plants is an important source of bacterial contamination, including dangerous pathogens, and highlights the need for control measures to prevent airflow from dirty to clean areas.

Main Results

High bacterial counts, including *Salmonella*, were detected in the air in Irish beef, lamb and pork plants.

Opportunity/Benefit

This project provides important information supporting the control of airborne contamination in meat processing plants as part of the hazard analysis and critical control point (HACCP) programme or as a prerequisite activity.

Collaborating Institutions

N/A

Project Number: 5415

Funding Source: FIRM 04/R&D/TN/251

Date: June, 2012

Project Dates: Sept 2005 – Oct 2008

How to Proceed

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UPDATE

Alimentary Pharmabiotic Centre: Microbe Interactions in the Gastrointestinal Tract

Key External Stakeholders

Food manufacturers, pharmaceutical industry, gastroenterologists, wider research community.

Practical Implications for Stakeholders

It is widely recognised that the gut microbiota plays an important role in human health and this is currently one of the most dynamic, complex and exciting areas of research in both the food and pharmaceutical arenas. The mining of the gastrointestinal tract (GIT) has revealed that the gut microbiota represents a repository of potential therapeutic molecules for food and pharmaceutical applications.

APC Microbiome Institute
Interfacing Food & Medicine

Main Results

- The antimicrobial Thuricin CD has been patented and is licensed to Alimentary Health for the treatment or prevention of *Clostridium difficile* infection.
- Bacteriophages MR299–2 and NH-4 can eliminate *Pseudomonas aeruginosa* in a murine model of Cystic Fibrosis and this combined with other results has led to the establishment of Phageworks™ – a one-stop development and IP licensing company bringing phage based products to market for customers.
- The novel antimicrobial Bactofencin LS1 is effective for the control of both *Listeria monocytogenes* and *Staphylococcus aureus*. Bactofencin LS1 has been patented and is currently undergoing a programme of investigation with the Irish SME Sigmoid Pharma.

Opportunity/Benefit

A bank of novel antimicrobials produced by GI microbiota is available for development.

Collaborating Institutions

Teagasc, University College Cork, University of Alberta Canada

Project number: 5271

Date: Spring 2014

Funding source: SFI

Project dates: Sept 03 – Sept 2013

How to Proceed

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UPDATE

Anti-MRSA – Phage Therapy Alternatives for Controlling MRSA

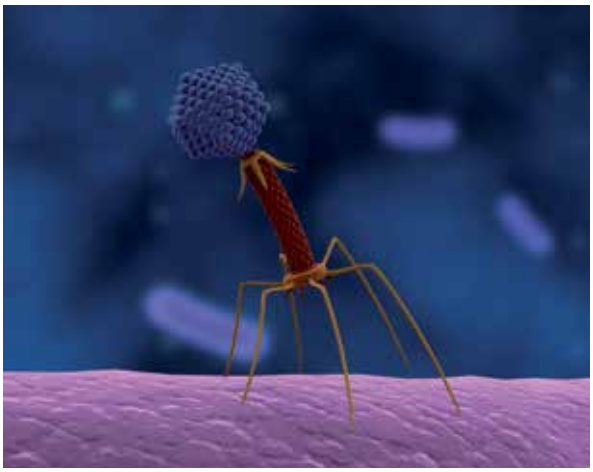
Key External Stakeholders

Pharmaceutical companies; bacteriophage-based therapeutics companies and research communities.

Practical Implications for Stakeholders

- A single protein called LysK, from the bateriophage staphylococcal phage K, was shown to inhibit drug-resistant strains of *Staphylococcus aureus*.
- The protein has the ability to kill live methicillin resistant *S. aureus* (MRSA) and could be a strong candidate for commercialisation.

This discovery is important because antibiotic resistant *S. aureus* strains, in particular MRSA, are major causes of hospital related infections worldwide. The emergence and increasing incidence of these so called 'superbugs' combined with the absence of new antibiotics from the pharmaceutical sector demands that alternative anti-MRSA agents are evaluated and



developed as a matter of urgency. The project exploited the use of bacteriophages, i.e. natural, specific anti-bacterial viruses, to eliminate antibiotic resistant *S. aureus* strains in biological environments.

Main Results

- Purified LysK protein is effective at eliminating MRSA in broth, cell culture, milk and blood.
- The phage eliminated *S. aureus* in the nostrils of mice.
- MRSA was not isolated from any of the pig herds tested to date and only a small percent (<2%) of personnel involved in the pig industry in Ireland are carriers of MRSA.

Opportunity/Benefit

There is a need for further research funding and development to further investigate the true potential of LysK as a potent pharmaceutical product against MRSA with a view to commercialisation. Expressions of interest from relevant companies are welcome.

Collaborating Institutions

University of Limerick, University College Dublin, Athlone IT, Cork IT, National MRSA Reference Lab – St. James Hospital.

Project Number: 5601

Funding Source: SFI (05/RF/BIM004)

Date: May, 2011

Project Dates: Jun 2006–May 2009

How to Proceed

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UPDATE

Anti-Oxidant and Anti-Microbial Compounds from Dandelion Root, Fenugreek and Bitter Melon

Key External Stakeholders

Vegetable processors, functional food manufacturers, government authorities/legislators, consumers, food research scientists

Practical Implications for Stakeholders

- The bioactive constituents in dandelion root, fenugreek and bitter melon, offer promising leads as sources of natural alternatives to synthetic food additives/preservatives.
- In particular, the ethyl acetate extract of *T. officinale* (dandelion) root has demonstrated strong antioxidant and antimicrobial properties which may warrant further investigation in food matrices as a potential functional food ingredient.

Main Results

- The ethyl acetate extracts (1mg/ml) of *Trigonella foenum-graecum* (fenugreek) seeds had the highest antioxidant activity (DPPH IC_{50} = 212 µg/ml) but showed no anti-microbial activity.
- The ethyl acetate extract of *Momordica charantia* (bitter melon) exhibited antimicrobial activity against *S. aureus*, MRSA and *B. cereus* strains (MIC = 62.5 – 93.8 µg/ml) while the *n*-hexane extract and a methanol-hydrophilic dialysed extract of *M. charantia* fruit demonstrated the best antioxidant activity in comparison to all other extracts from this species (DPPH IC_{50} = 575 – 648 µg/ml).
- Dandelion roots (*T. officinale*) contain 1,5-dicaffeoylquinic acid as a major antioxidant compound while its ethyl acetate extract demonstrated the strongest antimicrobial activity against *S. aureus*, MRSA and *B. cereus* strains (MIC = 250 – 500 µg/ml).
- A number of previously unreported compounds (4-Hydroxyphenylacetic acid derivatives of inositol) were isolated from dandelion root that could have useful biological properties not under investigation here.

Opportunity/Benefit

Dandelion roots were shown to have substantial anti-oxidant and anti-microbial properties. The outcomes of the project demonstrated that these under-utilised plants, generally considered weeds, can be potentially exploited as natural food preservatives and for nutraceutical applications.

Collaborating Institutions

University College Dublin

Project number: 6038

Funding source: Teagasc

Date: November, 2015

Project dates: Oct 2009 – Jan 2014

How to Proceed

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UPDATE

Antioxidant Status of Fully Processed Fruits, Vegetables and Their Products: Technology Optimisation to Minimise Losses

Key External Stakeholders

Vegetable processors, government authorities/ legislators, consumers, food research scientists.

Practical Implications for Stakeholders

Thermal and non-thermal processing effects on fruits and vegetables influence their antioxidant capacity.

The outcomes of the investigation are:

- Thermal processing such as *sous-vide* and post-processing storage decrease the antioxidant activity and concentration of antioxidant compound groups in fruits and vegetables.
- However the effect is not clear cut with some thermal and non thermal strategies resulting in an increase in antioxidant activity.

- In general post-processing storage at temperatures above 0°C resulted in a decrease in antioxidant levels.

Main Results

- Sous-vide processing is a promising strategy for retaining the antioxidant capacity and colour of thermally processed carrot disks.
- High hydrostatic pressure processing at ambient temperature and pressures of 400–600 MPa is an excellent food processing technology which has the potential to retain antioxidant compounds in strawberry, blackberry, tomato and carrot puree while also ensuring the foods are effectively pasteurised.
- Blast freezing and storage at -18°C is a good technique for preserving ascorbic and antioxidant activity in broccoli and greens but not carrots, provided the samples had been blanched prior to freezing.

Opportunity/Benefit

This project developed relatively novel processing techniques, sous-vide and high hydrostatic pressure processing, which are attractive options for end-users as they allow retention of antioxidants in fruits and vegetables and also aid in increasing the shelf-life of the products. Expressions of interest in this research are welcome.

Collaborating Institutions

University of Limerick

Project number: 5414

Funding source: DAFF (04/R&D/UL/327)

Date: March, 2012

Project Dates: Jan 2005 – Sep 2010

How to Proceed

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UPDATE

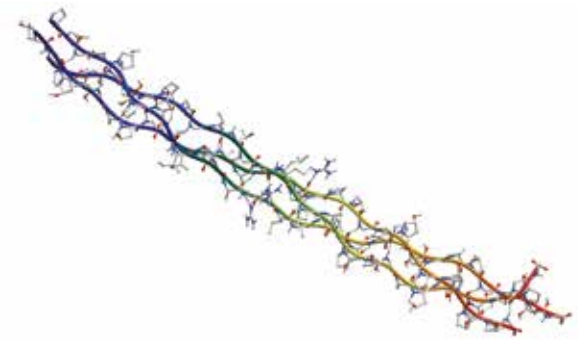
Assessing Pig and Sheep Industry By-Products as Sources of Constituents of High Value Biomaterials

Key Stakeholders

Meat sector, biomedical, cosmetics.

Practical Implications for Stakeholders

A dressed carcass is approximately 55% of a live animal weight resulting in 45% offal/viscera, blood, etc. While there are existing markets for some products e.g. offal many of these are low in value. Much of this material can be considered as a rich source of proteins, which have great potential for cosmetic, pharmaceutical and tissue engineering and regenerative medicine applications. This project will evaluate these meat processing streams and identify those with potential for extracting valuable proteins with regenerative medicine and pharmaceutical potential (e.g. collagens, glycosaminoglycans, proteoglycans). Sample handling and processing systems to extract out the valuable components will be developed. The quality, purity and allergenic status of the proteins will be assessed. Industry players have expressed strong interest in this research strategy and hence this project will be carried in close communication/collaboration with industry.



Main Results

This project will:

- Establish sample handling and processing protocols for the extraction of collagen, proteoglycans and glycosaminoglycans;
- Assessing protein quality / purity by SDS-PAGE, HPLC, amino acid analysis, western blots;
- Assess cytocompatibility by in vitro cultures with dermal and lung fibroblasts;
- Assess immune response by in vitro cultures with macrophages.

Opportunity/Benefit

This proposal aims to address challenges facing exploitation of the opportunities presented to the meat sector, namely extracting functional components and assessing functional activity. A successful out come to this project will provide the meat sector with clear knowledge about the best source materials for biomedical and cosmetic applications, in addition the expertise and ability to carry out this processing will be held in Ireland, which will also greatly enhance the Irish biomedical industry.

Collaborating Institutions

Network of Excellence for Functional Biomaterials (NFB), NUIGalway.

Project Number: 6577

Funding Source: Teagasc WF

Date: April 2014

Project Dates: Oct 2014 – Sept 2018

How to Proceed

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UPDATE

Assessment of DNA Markers for Meat Quality Traits in Irish Beef and Pork

Key External Stakeholders

Breeders, meat processors, diagnostics companies.

Practical Implications for Stakeholders

The outcomes of this project highlight the importance of investigating and understanding the molecular basis of quality traits for meat, with a view to optimisation of management systems for quality. These hold potential quality prediction tools for meat management systems and/or to provide a basis for the inclusion of meat quality in selection goals. This research validated some of the DNA markers tested in Irish crossbred cattle populations, and novel SNP markers associated with tenderness in Irish crossbred cattle identified.

- A number of candidate genes have been identified as potentially relevant to beef sensory and technological traits.
- DNA markers have been tested and were shown to be associated with quality parameters.

There is a need for tools to discriminate meat on the basis of quality and select sires for improved quality.

Variability in meat quality presents many problems for the industry and for consumer satisfaction. The underlying causes are multi-factorial in nature and are considered to include difference in the genetic profile (genotype) of the animal. Attributes of relevance to the consumer sensory experience include tenderness, colour, juiciness, flavour and texture; while those directly impacting on industry management systems include water holding capacity and colour. Management systems to predict and optimise these attributes require clear understanding of the factors underpinning variability. Currently eating quality is a major deficiency in breeding programmes and this is reflected along the beef chain from processors to retailers, who have highlighted the necessity for tools to accurately predict quality, in particular tenderness. Water-holding capacity has additional importance due to its ability to influence processed product quality and the financial losses incurred when it is sub-optimal.

Main Results

- Novel single nucleotide polymorphisms (SNPs) developed which are associated with tenderness (shear force on day 14 and sensory tenderness) and intra-muscular fat (flavour, juiciness) content.
- SNP in CAST, PRKAG3, GHR and SCD genes were associated with muscle colour and PRKAG3 was also shown to be associated with cook loss in beef.
- SNP in CAPN1 and ANK1 were confirmed to be associated with shear force (tenderness).
- A GHR polymorphism was associated with composition of muscle including moisture, intra-muscular fat and protein content in loin and rump muscles.
- Commercially available markers were tested (and subset validated) for association with Irish beef quality.

Opportunity/Benefit

This research validates the genomic approach to meat quality and expansion of this research area is recommended. The further development of these and other markers for independent traits to create tools for prediction of quality would have a wide range of potential applications spanning animal production and meat management systems.

Collaborating Institutions

University College Dublin

Project Number: 5421

Funding Source: DAFF (04/R&D/TN/258)

Date: October, 2011

Project Dates: Feb 2006 – Jul 2008

How to Proceed

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UPDATE

BASELINE: Risk Targets in Milk and Dairy Products

Key External Stakeholders

Dairy industry, European Food Safety Authority (EFSA)

Practical Implications for Stakeholders

The study focused on the risk posed by *Listeria monocytogenes* in raw and pasteurised milk cheese. The study showed that *L. monocytogenes* grew at a faster rate on pasteurised milk cheese compared to raw milk cheese during the storage period following ripening. A quantitative risk assessment model predicting the growth and survival of *Listeria monocytogenes* in raw and pasteurised milk cheese, from farm to fork showed that the mean level of exposure to *L. monocytogenes* in contaminated cheese was higher for raw milk cheese (2.22 $\log_{10}$ cfu g^{-1}) compared to pasteurised milk cheese (<1 $\log_{10}$ cfu g^{-1}). This model can support food processors to optimise conditions to reduce *L. monocytogenes* growth in cheese and to comply with EC2073/2005.

This research was carried out as part of a multi-national EU Framework project, *BASELINE* which focused on research to provide harmonised and validated sampling strategies, supporting European policies in food safety and suitable for food producers to collect comparable data, to improve quantitative risk analysis of selected biological and chemical agents.

Research by Teagasc in this project focused on the growth kinetics of *L. monocytogenes* in semisoft rind washed cheese prepared from raw and pasteurised milk, in the storage period following ripening. Additionally work focused on predicting the risk posed by the *Listeria monocytogenes* contamination arising from the farm environment as well as cross-contamination at processing and retail level, and subsequent human exposure, using a quantitative risk assessment modeling approach.

Main Results

- *L. monocytogenes* grew at a slower rate on the raw milk cheese compared to the pasteurised milk cheese at all the storage temperatures investigated.
- The simulated quantitative risk assessment model showed that the mean level of exposure to *L. monocytogenes* in contaminated cheese was higher for raw milk cheese (2.22 $\log_{10}$ cfu g^{-1}) compared to pasteurised milk cheese (<1 $\log_{10}$ cfu g^{-1}).
- A model sensitivity analysis highlighted the critical factors for exposure to *L. monocytogenes* from both cheeses were the serving size of the cheese, storage days and temperature at distribution stage.
- The model showed that when the Performance Objective (PO) for *L. monocytogenes* in raw milk cheese was set at ≤ 2 log cfu g^{-1} at retail level, nearly 10.34 % of product was predicted to exceed this PO limit, whereas the model predicted 100% of pasteurised milk cheese met the PO target.

Opportunity/Benefit

The study showed that growth kinetic models can facilitate prediction of *L. monocytogenes* growth during shelf-life and will help to demonstrate compliance with food safety criteria (EC 2073/2005). Further, the quantitative risk assessment conducted based on a farm-to-fork approach also showed possible cross-contamination of raw milk at farm level and retail level. Such model predictions, will allow food processors and policy makers to identify the possible routes of contamination in cheese processing and to reduce the risk posed to human health.

Collaborating Institutions

18 international collaborators, for details contact Geraldine Duffy.

Project number: 5994

Date: Jan 2014

Funding source: EU Seventh Framework Programme

Project dates: June 2008 – November 2013

How to Proceed

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UPDATE

Beef and Dairy Farm Hazard Analysis and Critical Control Point (HACCP) with particular emphasis on *Salmonella* Control

Key Stakeholders

Beef farmers, beef processors, scientists, regulatory personnel, EFSA

Practical Implications for Stakeholders

The data generated in this research should be used to develop HACCP type systems to control the incidence and spread of pathogens on farms. This should include a control point (CP) to ensure water used for animals is clean and pathogen free. Routine monitoring of livestock including non-food animals for *Salmonella* and Verocytotoxigenic *Escherichia coli* is also recommended and the importance of ensuring those in contact with animals, especially children, wash their hands properly afterwards is highlighted.

Main Results

- Water was identified as a source of *Salmonella* and cattle, deer and the farm dog were identified as vectors that may carry and/or spread VTEC around the farm and from farm to farm.
- *Salmonella enterica* Typhimurium DT193 was the predominant *Salmonella* serotype/phagetype detected. Although these isolates displayed a penta-resistant phenotype, this was not arranged in SGI1.
- Both *Salmonella* and VTEC survived for extended periods (up to 102 days) in the farm environment.

Opportunity/Benefit

This project provides data for risk analysis and the development of hazard analysis and critical control point (HACCP) type systems for farms, to minimize pathogen carriage in livestock. The results are available for any interested parties.

Collaborating Institutions

University College Dublin

Project Number: 5406

Funding Source: US-Ireland Fund

Date: June, 2012

Project Dates: Nov 2004 – Oct 2007

How to Proceed

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UPDATE

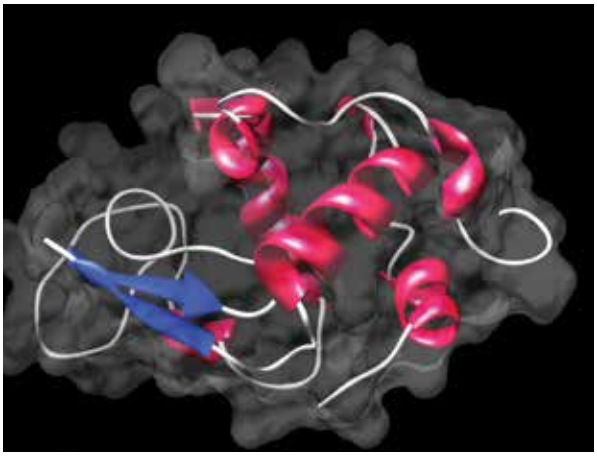
Bioactive Dairy Protein Complexes – *In Vitro* and *In Vivo* Digestion

Key External Stakeholders

Food, feed and pharmaceutical industry

Practical Implications for Stakeholders

- Whey proteins can act as delivery vehicles of small molecules such as fatty acids, thereby changing their biological activity.
- *In vitro* and *in vivo* tools are available within Teagasc to assess digestibility, bioaccessibility and bioavailability of food compounds.



Main Results

The key results were:

- α-lactalbumin (α-la) and β-lactoglobulin (β-lg), both whey proteins, can bind small hydrophobic molecules and act as delivery vehicles to cells.
- α-la and β-lg can alter the solubility of fatty acids, thereby affecting their biological activity e.g. increasing or decreasing their anti-tumour activity or delay the uptake of fatty acids.
- *In vivo* gastric digestion of α-lactalbumin in adults (n=10) provided valuable and novel insight into the mechanism and kinetics of protein breakdown.

Opportunity/Benefit

The research team in Teagasc Moorepark has developed *in vitro* and *in vivo* tools to assess the digestive mechanism of food components. Assays such as bioaccessibility and bioavailability are now available to interested end users.

Collaborating Institutions

Trinity College Dublin
University College Cork

Project number: 5947

Date: May , 2013

Funding source: FIRM 08/RD/TMFRC/650

Project dates: Nov 2008 – Feb 2013

How to Proceed

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UPDATE

Bio-Actives from By-Products of Food Processing

Key External Stakeholders

Vegetable processors, government authorities/ legislators, consumers, national food research institutes.

Practical Implications for Stakeholders

Large volumes of waste are produced as a result of processing of foods. This project highlighted the potential of this waste as a source of bio-active compounds for inclusion in functional foods.

Main Results

- Fruit and vegetable by-product and waste sources in Ireland were tested for their antioxidant activity and polyphenol content. The highest levels of antioxidants measured by both ferric reducing antioxidant power (FRAP) and diphenyl-picrylhydrazyl (DPPH) assays were detected in whole kiwifruit. Of the vegetable by-products, broccoli stems showed the best antioxidant potential.
- A pressurised liquid method for the extraction of antioxidants from apple pomace utilising 60% ethanol at a temperature of 102°C was developed.
- A solid-liquid extraction method for recovering antioxidant from apple pomace was also developed utilising 56% ethanol, 80°C and 31 min.
- Chitin extraction optimisation, using different organic acids, times and temperatures, was evaluated. The optimal conditions for chitin extraction were 2M concentration, 2h steeping time 24ºC temperature which resulted in 98.86% and 90.28% purity for citric acid and lactic acid, respectively, at the ratio of 1:10.
- Optimal conditions of 75% ethanol, 80ºC and 22 min for the extraction of antioxidants from potato peel were determined using solid-liquid extraction. The use of pressurised liquid extraction did not enhance the extraction of antioxidants from potato peel.

Opportunity/Benefit

The potential of high volume fruit, vegetable and fish processing waste as a source of bio-active compounds has been highlighted. A number of methods for the recovery of bio-active compounds using food friendly solvents have been developed. The methodologies developed could be used as a basis for up-scaled methods to recover bio-active compounds from food waste for inclusion in functional foods.

Collaborating Institutions

Dublin Institute of Technology, National University of Ireland, Galway, Trinity College Dublin, Natures Best Ltd, Keeling Fruit Importers

Project number: 5713

Funding source: DAFM (06RDTAFRC519)

Date: November, 2011

Project Dates: Dec 2006 – Nov 2010

How to Proceed

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UPDATE

Biocide Tolerance in Foodborne Pathogens

Key External Stakeholders

Food industry, biocide producers, regulatory authorities.

Practical Implications for Stakeholders

The outcome of this project is a greater understanding of how foodborne pathogens including *E. coli* O157 and *Salmonella* spp. respond to the presence of biocidal agents, with a particular emphasis on triclosan.

- A panel of verocytotoxigenic *E.coli* (VTEC) and *Salmonella* isolates were found to have minimum inhibitory concentrations (MIC) less than the recommended working concentrations of a number of commercial biocide formulations, although some possessed an MIC of greater than 50% of the working concentration of some agents. This highlights the importance of strict adherence to manufacturer guidelines and appropriate training of personnel.
- Mutants with an enhanced tolerance to triclosan were readily obtained for both *Salmonella* and VTEC. In the case of *Salmonella* corresponding alterations to the strains' antibiotic profiles were observed, illustrating an additional public health risk.
- A spectroscopic method was developed for the detection of quaternary ammonium compounds on stainless steel surfaces, allowing for the detection of residue build up which may constitute a risk for pathogen exposure to sub lethal concentrations of such agents. This would increase the likelihood of resistance developing.

Main Results

A bank of foodborne pathogen isolates were tested against commercial biocide formulations. Although all isolates thad an MIC below the recommended working concentration for all the biocide formulations tested a concern is that for some isolate-biocide combinations the MIC was 50% of the working concentration. Such a concentration may easily occur in real world situations, either due to over dilution, handler error or high organic load. Through this study the transcriptomic and proteomic response of triclosan tolerant *E. coli* O157 and *Salmonella* mutants in comparison with their reference strains were characterised in detail, identifying key responses for each pathogen. Subsequent phenotypic studies showed key changes which may contribute to enhanced pathogen persistence. A spectroscopic method was developed for measuring the potential buildup of biocidal agents on industrial surfaces.

Opportunity/Benefit

The findings of this project provide a detailed analysis of the response of two key foodborne pathogens to sub lethal exposure to biocides commonly used in the farm to fork chain and how these responses may contribute to pathogen persistence in the food chain. The project findings underline the key importance of utilising biocidal agents as directed. Furthermore, the spectroscopic method developed and validated as part of this project is readily transferable to industry for the measurement of the buildup of biocide residues on industrial surfaces.

Collaborating Institutions

University College Dublin

Project Number: 5954

Funding Source: DAFM 08/RD/TAFRC616

Date: November 2012

Project Dates: Dec 2008-May 2012

How to Proceed

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UPDATE

Biocontrol of Verocytoxigenic *Escherichia coli* at Key Stages of the Beef Chain

Key External Stakeholders

Beef industry.

Practical Implications for Stakeholders

Verocytotoxigenic *Escherichia coli* (VTEC), particularly *E. coli* O157:H7 are a major food safety concern worldwide. Healthy ruminants can harbour VTEC in their gastrointestinal tract and can shed the pathogen in their faeces, leading to contamination of the hide, carcass and/or meat products posing a potential public health risk and commercial damage to the beef sector. There is a need for targeted controls against *E. coli* O157 at key points of the beef chain coupled with a demand for natural biological controls, due to increased consumer resistance to use of chemicals. The key finding from this study was that biocontrol

agents (particularly phages and carvacrol) show great potential as novel controls against *E. coli* O157:H7 at key stages of the beef chain and further research on their development and application is being pursued.

Main Results

- Carvacrol and thymol were shown to inhibit and kill *E. coli* O157:H7 and other VTEC in a model broth system and retained their antimicrobial activities across a wide range of environmental conditions tested (e.g. temperature, pH, water activities etc).
- Carvacrol (3%) reduced *E. coli* O157:H7 numbers by 10 fold on beef hide and carcass.
- Bacteriophages e11/2 and e4/1c inhibited and killed *E. coli* O157:H7 in a model broth system and retained activity under a range of environmental conditions.
- Bacteriophage significantly reduced *E. coli* O157:H7 in a model rumen system without affecting the natural microflora or fermentation.
- Bacteriophage sprayed on to hide could reduce *E. coli* O157:H7 by 100 fold.

Opportunity/Benefit

Advice, consultancy work and/or technical services can be provided by Teagasc in the area of pathogen biocontrols.

Collaborating Institutions

N/A

Project Number: 5638

Funding Source: DAFF (05/R&D/TN/356)

Date: November, 2010

Project Dates: Jan 2007 – Dec 2009

How to Proceed

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UPDATE

BIOCONTROL: Bio-active Ingredients for the Control of Undesirable Bacteria in Ready-to-Eat Foods

Key External Stakeholders

Food manufacturers and processors.

Practical Implications for Stakeholders

In 2003, the US Food and Drug Administration issued a Final Rule which explicitly states that post-processing technologies must be included to limit the growth of *Listeria* in ready-to-eat products.

The Biocontrol project has resulted in the generation of a suite of food grade antimicrobials on which future novel anti-*Listeria* biopreservative products could be based.

- The identification of nisin derivatives with enhanced activity against Gram positive pathogens, including *Listeria*, is a major breakthrough. The fact that single amino acid changes can have such dramatic impacts is particularly noteworthy. From a commercial perspective it is significant that nisin is the only bacteriocin which has been approved as a food additive and nisin derivatives may be more likely to be approved by authorities than completely new compounds. In addition, nisin has been shown to have a number of other applications in animal and human health. Thus enhanced forms of nisin have the potential to impact on food safety, health and agriculture.

- A *Lactobacillus salivarius* strain producing an ABP118-like bacteriocin, which we designated salivaricin P, was identified. The fact that bacteriocins are produced by potentially probiotic strains is relevant to industry and consumers, since such strains could potentially be employed to control pathogens in the gut or to alter the overall gut microbial composition in a beneficial way.

Main Results

- Novel anti-*Listeria* agents were identified and developed.
- Food trials to demonstrate effectiveness were performed.
- Patented IP resulted.

Opportunity/Benefit

A patent relating to the novel nisin derivatives was filed: Publication number: WO2011076903

Collaborating Institutions

University College Cork

Project Number: 5367

Funding Source: DAFF (04/RD/C/232)

Date: March, 2012

Project Dates: Jul 2005 – Jun 2009

How to Proceed

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UPDATE

BioCop – Detecting Chemical Contaminants in Food

Key External Stakeholders

Dairy, beef and sheep farmers, regulatory agencies e.g. DAFF, FSAI, IMB.

Practical Implications for Stakeholders

- It is now possible to screen a large series of samples for the biological effects caused by the use of a growth promoting hormone using BioCop, a cost-efficient, protein based biomarker biosensor assay that has been developed.
- Rapid, improved diagnostic methods that are able to detect low concentrations of fluoroquinolone antibiotics have been developed and can be used in a range of animal products, including chicken muscle, eggs and fish.

BioCop addressed the issue of hormone growth promoters because they are banned for use in cattle fattening in the EU. Hormone abuse is a concern from food safety, animal welfare and law enforcement perspectives as residues in meat are a potential health threat, especially for vulnerable populations such as preadolescents. Current analytical methods are restricted, (i) to a limited number of known substances and, (ii) by the relative high cost. Therefore unexpected compounds will be overlooked and the number of samples analysed is limited by the cost.

BioCop addressed the issue of veterinary drug residues in food (fluoroquinolone antibiotics and hormone growth promoters) because overuse and/or illegal use of fluoroquinolone antibiotics in animal production is of particular concern to humans. Repeated exposure to fluoroquinolones, via the food chain, will limit the future effectiveness of these drugs by increasing the risk of antimicrobial resistance developing.

Main Results

- New biosensor assay developed to detect fluoroquinolone antibiotics in different foods.
- A new high throughput biosensor assay was developed to detect hormone abuse in cattle.

Opportunity/Benefit

This range of novel screening assays for chemical contaminants in food will provide the industry with a more cost effective and efficient food testing service allowing for an increase in safety and reduction in expenses. Expressions of interest in this research and the novel assays developed are welcome.

Collaborating Institutions

Queens University Belfast

Project Number: 5442

Funding Source: EU (FOOD-CT-2005-006988)

Date: July, 2011

Project Dates: Apr 2005 – Sep 2009

How to Proceed

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UPDATE

Biologically Active Complexes of Bovine Milk Proteins

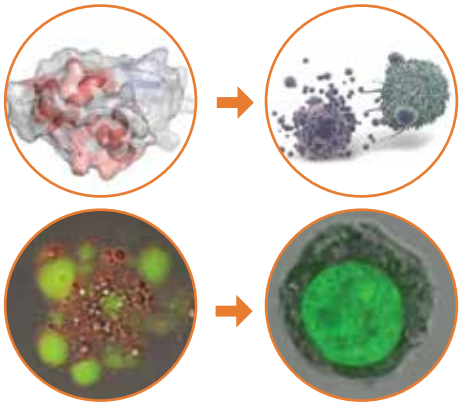
Key External Stakeholders

Scientific community, biotechnology start-up companies, Irish dairy companies, infant formula manufacturers.

Practical Implications for Stakeholders

- Processing of the whey protein α-lactalbumin does not impair its potential anti-tumour properties.
- Some protein/fatty acid complexes may have the potential to be used for pharmaceutical purposes.

Milk Protein Complexes → Cancer Cell Death



Main Results

Globular proteins such as α-lactalbumin and β-lactoglobulin can act as vehicles for delivering oleic acid to tumour cells, thereby inducing cell death by apoptosis.

Opportunity/Benefit

The expertise and techniques developed for screening proteins as molecular delivery systems of bio-active components is available for interested companies and academic institutes.

Collaborating Institutions

University College Cork, Trinity College Dublin

Project Number: 5452

Funding Source: Dairy Levy Fund

Date: February, 2010

Project Dates: Jul 2005–Dec 2009

How to Proceed

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UPDATE

Biomarkers to Authenticate Irish Grass-Fed Beef

Key External Stakeholders

Regulatory agencies, Bord Bia, beef producers/ processors.

Practical Implications for Stakeholders

- Biomarkers to authenticate Irish grass-fed beef have not been identified and, therefore, the marketing advantage that should accrue by being able to prove unequivocally that beef is Irish and grass-fed has not been exploited.
- This project produced a unique and extensive dataset consisting of marker elemental isotopes, molecules, and differentially expressed genes characterising (i) Irish beef produced solely off grass or off concentrates or off silage/grass/ concentrate combinations and (ii) non-Irish beef.
- The approach taken will be useful for individual producers seeking to market beef produced to a unique and defined regional production system.

Main Results

- Stable isotope analysis and fatty acid analysis permitted 100% correct classification of grass-fed beef from concentrate-fed beef and from beef from animals fed a 50:50 combination of grass and concentrates.
- Discriminant analysis of stable isotope data from 146 international samples showed that 84.9% were correctly assigned to their country of origin.
- Stable isotope analysis of bovine tail hair provided an archival record of the pre-slaughter diet of beef cattle and, importantly, of changes (e.g. grass to concentrates) to the pre-slaughter diet.

Opportunity/Benefit

Commercialisation of this research could involve the setting up of a food authentication testing facility involving the establishment and maintenance of databases against which routine or suspect samples would be tested.

Collaborating Institutions

University College Dublin

Project Number: 5644

Funding Source: DAFF (06/R&D/D/481)

Date: November, 2011

Project Dates: Sep 2006 – Nov 2010

How to Proceed

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UPDATE

Bio-Sensitives Advanced Stabilisation

Key External Stakeholders

Dairy Ingredients and Nutritional Beverage Manufacturers.

Academic and Research Institutions.

Practical Implications for Stakeholders

The research investigates processes, such as dehydration, as a way of stabilising sensitive and bioactive food components in structure-forming food matrices.

- Stabilisation of high-value ingredients requires a thorough understanding of ingredient interactions during formulation, processing, storage and distribution. The research demonstrates the effects of altering the composition of the continuous phase of emulsions on microstructure and physical properties of resultant powders such as glass transition temperature, sugar crystallisation, and lipid oxidation.

- The production of nanoemulsions, using microfluidisation for spray drying, with carbohydrate glass-formers has potential as a technique for increased retention of active components and uniformity of powder particle structure.

Main Results

The project utilised microfluidisation equipment for the production of nanoemulsions (fat globule size ~ 150 nm), which may be used for encapsulation of lipid soluble bioactives by spray drying to produce powdered ingredients. Spray drying produced a solid, glassy matrix with sensitive components as part of the glassy material or entrapped in the structure-forming matrix (solid-oil dispersion). The research showed the impact of reducing the fat globule size on the physical properties of emulsions and powders. Spray dried nanoemulsions had altered microstructure compared to the control powders, with reduced levels of lipid oxidation but increased rates of lactose crystallisation. Partial replacement of lactose with sucrose, reduced glass transition temperature (T_g), delayed lactose crystallization and reduced the extent of lipid oxidation in powders – a possible beneficial effect for long term storage of powders.

Opportunity/Benefit

This research provides a comprehensive account of the fundamental properties of nanoemulsions in liquid and dried forms. The techniques described can be translated into improved product quality and stability with demonstrable benefits to the Irish industry as producers of high quality ingredients and foods for the international markets.

Collaborating Institutions

University College Cork, UCC

Project number: 5953

Date: November, 2014

Funding source: DAFM (08/RD/C/695)

Project dates: Oct 2008 – Mar 2013

How to Proceed

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UPDATE

Buttermilk Powder and Cheese Yield

Key External Stakeholders

Dairy processing industry.

Practical Implications for Stakeholders

Buttermilk powder is readily available and despite containing high levels of potential natural emulsifiers, its use to fortify cheese milk protein levels results in significantly reduced adjusted cheese yield due to increased losses of both fat and protein to whey.

- Fortification of cheese milk with buttermilk powder results in cheeses with significantly higher levels of moisture and moisture-in-non-fat-substance levels. Fortification with milk ultra filtration retentate produces cheeses with significantly lower levels of moisture and moisture-in-non-fat-substance levels, in comparison to cheeses produced from control cheese milks.
- Fat losses to whey were higher (20-30%) in cheeses produced from milks fortified with buttermilk powder compared to control cheeses (15-18%). They were also significantly higher when compared to cheeses produced from milks fortified with milk ultra filtration retentate (9-12%).

- Analysis of moisture adjusted cheese yields in which fat and protein contents adjusted to reference levels showed yields of cheeses produced from milks fortified with buttermilk powder (10.48%) were lower than control cheeses (10.85%) and were significantly lower than cheeses produced from milks fortified with milk ultra filtration retentate (11.42%).

Main Results

- This study concluded that despite containing high levels of potential natural emulsifiers, the use of buttermilk powder to fortify cheese milk protein levels results in significantly reduced cheese yield due to increased losses of both fat and protein to whey.
- However the study does highlight the potential for the cheese industry for fortification of cheese milk with milk ultra filtrate to reduce losses to whey and to increase cheese production efficiencies.

Opportunity/Benefit

The enhanced knowledge base arising from this study is available to industry decision makers in order to assist them in increasing cheese manufacture yield efficiency.

Collaborating Institutions

N/A

Project Number: 5980

Funding Source: Dairy Levy Fund

Date: March, 2012

Project Dates: Jun 2009–Jun 2011

How to Proceed

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UPDATE

Campylobacter Control on Broiler Farms

Key Stakeholders

Poultry farmers, poultry processors, scientists, regulatory personnel, EFSA

Practical Implications for Stakeholders

- The data generated in this research should be used to revise current biosecurity measures on broiler farms.
- New information on antibiotic resistance can be used to assess the likely success of different control strategies.

This research also supports the hypothesis that quinolone and macrolide antibiotic resistance in *Campylobacter* is mutation based. While this trait may not be transferred horizontally from one organism to another, it is relatively stable in the *Campylobacter* population and can be passed vertically between parents and offspring cells. The use of antibiotics during food production will confer a selective pressure

promoting the survival and proliferation of resistant strains while susceptible organisms are eliminated from the microflora with inevitable adverse consequences for therapeutic intervention (in severe cases) and public health.

Main Results

- Adjacent cattle and transport crates used during thinning are important sources of *Campylobacter* in broiler houses.
- Quinolone and macrolide antibiotic resistance in Irish *Campylobacter* isolates is mutation based.

Opportunity/Benefit

This project provides data for risk analysis that may be used to provide the scientific basis for improved biosecurity of broiler farms and in the formulation of strategies to control the emergence and dissemination of antibiotic resistance determinants in *Campylobacter*. The results are available for any interested parties.

Collaborating Institutions

University College Dublin, Cork County Council.

Project Number: 5427

Funding Source: Safefood 04-RESR-04

Date: June, 2012

Project Dates: April 2006 – Sept 2009

How to Proceed

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UPDATE

Characterisation and Enrichment of "Buttermilk" Fat Globule Membrane Composition Using Novel Technologies

Key External Stakeholders

Dairy processors, butter manufacturers, ingredient innovators.

Practical Implications for Stakeholders

This project has demonstrated that the milk fat globule membrane (MFGM) residue contained within buttermilk possesses biological activity and offers potential for greater commercial exploitation and adding value.

A key implication for dairy producers and processors is a realisation that buttermilk as a by-product of buttermaking is presently under-utilised through processing into a relatively low-value commodity buttermilk powder.

- Expertise and analytical capability were developed, in relation to bioscience aspects and technological features of MFGM, which is key to understanding the fate of MFGM proteins and phospholipids during processing.

- Specific analytical capabilities developed during the project were made available to interested dairy processors thereafter to enable them to characterise the composition of buttermilk and MFGM fractions generated by their processes. This, in turn, led to international food and nutritional company reaction e.g. expressions of interest on the part of infant milk formula manufacturers.

Main Results

- Analytical techniques were established which enabled, for the fist time, the fate of MFGM proteins and phospholipids to be tracked during processing simulations performed on freshly-produced milk.
- MFGM proteins are partitioned mainly into buttermilk during cream churning, some of these proteins were also detected in the resulting butter. All major MFGM phospholipids, i.e. PE (phosphotidylethanolamine), PI (phosphotidylinositol), PC (phosphotidylcholine), PS (phosphotidylserine), SM (sphingomyelin), as well as high quantities of LC (lactosylceramide) were detected in the various sample streams irrespective of mechanical action and/or heat treatment of cream prior to processing.
- Significant anti-cancer effects were detected in the various buttermilk fractions produced experimentally.

Opportunity/Benefit

Follow-on research is necessary to elaborate our scientific understanding of MFGM and document further biological evidence to support health benefit claims but the expertise developed from this project would be key to such commercially focused research and possible links with industry.

Collaborating Institutions

Dublin City University

Project Number: 5552

Funding Source: DAFF (05/R&D/TD/370)

Date: March, 2012

Project Dates: Oct 2008 – Mar 2009

How to Proceed

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UPDATE

Cheese 2030 – New Technology Platform

Key External Stakeholders

Manufacturers of cheese and milk protein ingredients.

Practical Implications for Stakeholders

A novel SMART cheese technology platform has been developed for the manufacture of specialised protein powders and recipes for converting these into cheeses with different functional properties. Key features of the technology include:

- Cheesemaking process without whey release in cast cheeses or limited whey release in structured cheese (e.g. ~ 25–30% of normal).
- Complete retention of any added materials (e.g. pre-biotics, minerals, vitamins) in cast cheese types.
- Enables cheesemaking operations in regions where fresh milk is not readily available.

- Ingredient manufacturing step resulting in production of clean 'whey' ideal for the manufacture of specialised whey products e.g. functional whey protein fractions, powders for inclusion in infant milk formula.

This platform technology provides more opportunity to design/control cheese characteristics such as texture, cooking properties and greater potential for the development of new generation health cheeses.

Main Results

A technology was developed for the manufacture of milk protein ingredients (MPI) with characteristics suited to the manufacture of cheeses with different physical properties.

The dispersion, hydration and gelation properties of the MPI were affected by mineral composition, protein concentration, time, solvent quality factors (including ionic strength, pH, temperature).

A process for the conversion of MPI into:

- 'Cast' cheese variants with dry matter levels ≤ 50% without whey expression.
- 'Structured' cheese variants (with ≥ 50% dry matter) by subjecting the cast cheese to further curd handling and whey expression steps.

The composition, physical and sensory properties of the cheeses were altered by the following process variables: formulation (type and level of MPI, salt level, pH), ingredient dispersion/blending conditions (shear, temperature, duration), sequence of ingredient addition, gelation conditions (coagulant type, pH, temperature, time), curd handling processes, and addition of polysaccharides.

Opportunity/Benefit

This technology allows the development of prototype functional MPIs with unique technological characteristics for conversion into cheeses. Irish dairy companies have an opportunity to supply export markets with cheese ingredient solutions (MPIs and cheese conversion processes) which can be converted by *in-situ* re-hydration into local products.

Project number: 5857

Funding source: EI (TD/2007/0128)

Date: March, 2012

Project Dates: Apr 2008 – Oct 2011

How to Proceed

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UPDATE

Chitosan Generation and Characterisation from Shell

Key External Stakeholders

Marine processors, ingredient producers.

Practical Implications for Stakeholders

Use of by-products from marine processing and reduction in disposal at landfill costs.

Novel ingredient for use in a myriad of applications as a functional food (anti-obesity/anti-cholesterol), horticulture, plant protection.

Main Results

- Chitosan generation and characterisation from shell material (prawn and crab)
- NMR analysis and molecular weight determination.

Opportunity/Benefit

By-product disposal is expensive and no longer permitted under the revised CFP. We have developed methodologies to generate a high-value grade chitosan from prawn and crab shell material and methods to characterise the resultant product which has a myriad of applications in functional foods, foods, packaging and horticulture.

Collaborating Institutions

National University of Ireland, Galway

University College Dublin

Project number: NutraMara – The Marine Functional Foods Research Initiative

Date: May 2015

Funding source: DAFM and Marine Institute and Teagasc

Project Dates: October 2009 – December 2012

How to Proceed

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UPDATE

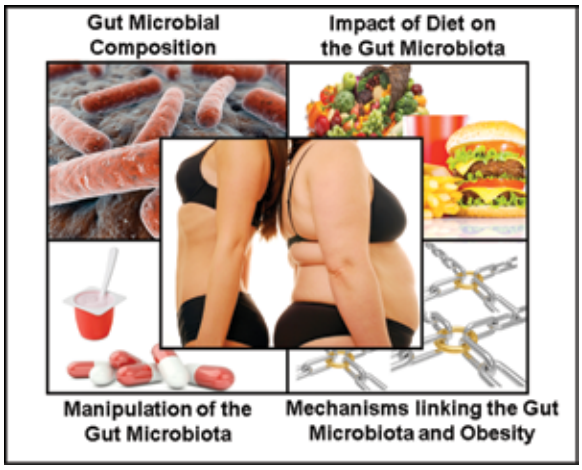
Controlling Obesity-Associated Gut Microbes

Key External Stakeholders

Irish food industry, Irish consumers.

Practical Implications for Stakeholders

The microbes in our gut (gut microbes) can contribute to weight gain. There is an opportunity to develop new weight management strategies by altering these microbial populations in a beneficial way. Through the course of this research we have provided that evidence that antimicrobial-producing probiotics, whey protein and exercise have the potential to bring about such beneficial changes.



Main Results

Through a variety of animal and human studies, we have investigated the obesity associated gut microbiota and have employed a variety of approaches with a view to changing this population in a beneficial way.

- We have established that a bacteriocin (antimicrobial) producing probiotic (*Lactobacillus salivarius* UCC118) more considerably alters the gut microbiota than a non-bacteriocin producing equivalent and that the changes induced bring about a short-term reduction in weight gain.
- We have revealed a desirable, high microbial diversity in the gut of elite athletes and have revealed a correlation between this high diversity with exercise and protein consumption, respectively.

Opportunity/Benefit

As a consequence of our studies, the potential benefits of employing bacteriocin-producing probiotics, protein and exercise to modulate the gut microbiota in a beneficial way have been highlighted. Further research will focus on optimizing the use of these intervention strategies (individually and in combination) to control obesity associated gut microbes.

Collaborating Institutions

UCC, APC

External Collaborators

Prof. Paul O'Toole, University College Cork, Alimentary Pharmabiotic Centre

Prof. Fergus Shanahan, UCC, APC

Dr. Eileen Murphy, UCC, APC

Project number: 5971

Date: June, 2014

Funding source: Teagasc

Project dates: March 2009-Apr 2014

How to Proceed

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UPDATE

Culture Collections in Teagasc Food Research Centre Moorepark

Key External Stakeholders

Dairy Industry, food manufacturers, pharm industry, research community.

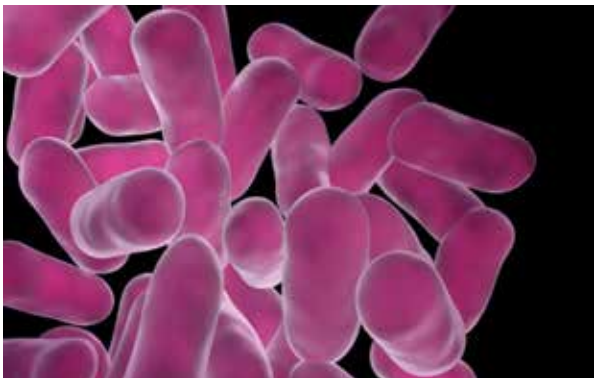
Practical Implications for Stakeholders

The culture collections in the Teagasc Food Research Centre Moorepark provide banks of bacterial cultures with potential for exploitation as dairy starters, adjunct cultures and probiotics for the Food and Pharma industries and the research community.

Main points

The main functions of the DPC and APC culture collections are:

- To provide a central repository for safe housing and cataloguing of DPC and APC Biobanks.



- To provide researchers within Teagasc and APC and interested stakeholders with accurate data regarding the potential applications, safety and quality of strains within the collections.

To provide unambiguous traceability for IP protection and accountability.

Main Results

DPC and APC culture collections contain 7000 and 62,000 strains respectively. The DPC culture collection predominately consists of strains of lactic acid bacteria of the genera *Lactococcus*, *Lactobacillus* and *Streptococcus*. These bacteria have been isolated over many years from a variety dairy-associated sources. In addition, this collection also houses bacteria and yeasts isolated from surface ripened cheese, many food, animal and human Class 2 pathogens and also bacteriophages isolated from both dairy and environmental sources. More recently the biobank associated with the APC contains strains isolated from human intestinal samples which have potential for exploitation as probiotics for the treatment of anti-inflammatory diseases such as IBD and IBS, anti-*Clostridium difficile* probiotics and antimicrobials in addition to strains producing bioactive metabolites such as conjugated linoleic acid and exopolysaccharides.

Opportunity/Benefit

The DPC and APC culture collections are available to researchers in Teagasc Food Research Centre, researchers in the APC and companies for exploitation in the Food or Pharma or Veterinary arena.

Collaborating Institutions

University College Cork

Project number: 6042 and 6312

Date: May 2014

Funding source: SFI and DAFM

Project dates: 2008–2013 and 2013

How to Proceed

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UPDATE

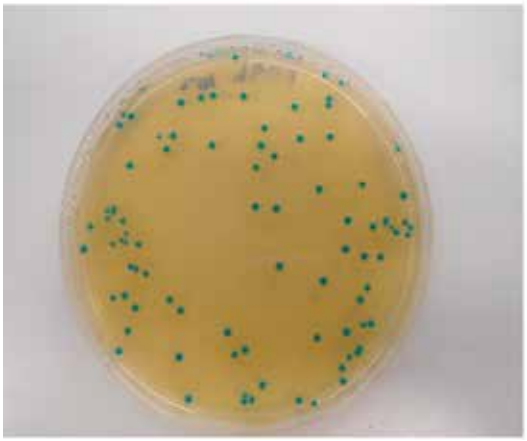
Detection and Surveillance of *Enterobacter Sakazakii* (*Cronobacter* spp.) Along the Infant Formula Food Chain

Key External Stakeholders

Infant milk formula industry, Food Safety Authority of Ireland.

Practical Implications for Stakeholders

Cronobacter spp. is a key food safety issue for the infant formula sector. Apart from an obligation to meet the regulatory microbiological criteria for this pathogen, the sector would be severely damaged by any food safety scare affecting infants consuming these products. This study has focused on transmission sources and survival characteristics of *Cronobacter* spp. The study highlighted that *Cronobacter* can occur widely in the environment and are particularly associated and adapted to survive in dry environs.



Main Results

- C*ronobacter* spp. are not 'ubiquitous' in the environment and would be best described as 'widespread but infrequent' as it appears they have found a particular niche in dry environments.
- Dry ingredients added to milk powder may have a role in transmission of *Cronobacter* spp.
- *Cronobacter* spp. are resilient, surviving the time/temperature profile experienced during spray-drying, in soil, in rumen fluid, in inulin and lecithin (ingredients in infant formula manufacture)
- An adaptive tolerance response to sub-lethal heat that confers increased heat resistance can be induced. However, the increased heat tolerance was not transferred to increased survival potential in a dry environment. Changes in the ratio of saturated to unsaturated fatty acids in the cell membrane appear to be responsible for this adaptation.

Opportunity/Benefit

This project has generated knowledge about the transmission and survival of *Cronobacter* in the farm to fork chain which will underpin risk management of this pathogen

Collaborating Institutions

University College Dublin, Food Safety Authority of Ireland

Project number: RMIS 5561

Date: October 2013

Funding source: FIRM

Project dates: June 2006 – Dec 2009

How to Proceed

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UPDATE

Detection of Endocrine Disrupting Agents in Milk

Key External Stakeholders

Dairy industry, Dairy farmers, Agri-businesses, Policy makers

Practical Implications for Stakeholders

Endocrine disruptor agents (EDAs) comprise of both natural occurring and synthetic chemicals. Some of these chemicals can transfer into milk due to environmental contamination, feed contamination, leaching from milking machine components, cleaning agents or processing. This research has shown that endocrine disruptors can be successfully detected in milk using receptor assays. However, chemical analysis using liquid chromatography coupled to tandem mass spectrometry (LC-MS/MS) is require to accurately measure and identify each compound. Unfortunately, a wider range of EDAs could not be detected because there are more amenable to GC-MS analysis, which was not available at the time.

Using the technology developed on this project further investigations should be carried out to identify the source of EDA contamination in milk. More extensive methodology is required to properly investigate a wider range of phthalates, which have been detected in dairy products in other EU countries.

Main points

- New technology is available for the detection of EDAs in milk.
- Research has shown that of number of EDAs are detectable in milk but at low parts per billion levels.
- More extensive methods need to be developed using GC-MS/MS to measure phthalate residues in milk.

Main Results

- Two new methods were developed to screen for endorcrine disrupting chemicals in milk using an estrogenic reporter gene assays and liquid chromatography coupled to tandem mass spectrometry (LC-MS/MS.
- The technologies were applied to a range of different types of milk and infant formula.
- A range of endocrine disruptors were detected in samples including the natural hormone progesterone and low levels antimicrobials, phytoestrogens and benzyl butyl phthalate.

Opportunity/Benefit

This technology is now available as a tool to monitor the safety of milk.

Collaborating Institutions

Queen's University Belfast

Project Number: 6141

Funding Source: Teagasc

Date: November, 2014

Project Dates: Oct 2010 – Sep 2014

How to Proceed

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UPDATE

Detection of Flukicide Residues in Milk and Meat

Key External Stakeholders

Meat and milk processors, Irish baby food industry, regulatory agencies e.g. DAFF, FSAI, IMB.

Practical Implications for Stakeholders

- The first analytical test to detect all of the major anti-parasitic drug residues has been developed through a collaboration with the US Department of Agriculture.
- A new group of residues in milk and meat samples were detected for the first time; nitroxynil, closantel, triclabendazole and rafoxanide were detected in milk at low levels. However, with setting of provisional Maximum Residue Limits (MRLs) for some flukicides in milk, this will become less of a problem from 2011 on.
- The technology developed under this funding has been comprehensively validated according to international guidelines and was accredited to the ISO 17025 standard. The technology has been applied to some 3000 test samples.
- The main recommendation for primary processors is that flukicide residues should be monitored in milk, particularly during the spring period post-calving.

Main Results

- A sensitive test was developed and validated to detect 38 anti-parasitic drug residues in milk and animals tissue.
- The technology was satisfactorily evaluated through application in inter-laboratory studies.
- The technology was accredited to ISO17025 standard in 2009.
- The technology has been applied to approximately 3000 test samples.

Opportunity/Benefit

This analytical test is now available as a tool to monitor the safety of milk and meat products through accurate determination of flukicide residue levels, and offers an opportunity for food processors to prevent contaminated product entering the food chain and potential product recalls, with all of the economic fallout this entails.

Collaborating Institutions

US Department of Agriculture – EARC

Project Number: 5579

Funding Source: DAFF (06/RD/TAFRC/479)

Date: January, 2011

Project Dates: Nov 2006 – Nov 2009

How to Proceed

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UPDATE

Developing Novel Convenient Meat Based Products by Application of High Pressure Processing (HPP)

Key External Stakeholders

Meat processors, chilled ready meal producers, state agencies.

Practical Implications for Stakeholders

The output of this research provides a broad range of data which can assist many players in the chilled meat product chain to understand the relevance of a minimal processing technology such as high pressure processing (HPP). Results also provide valuable information to assist in understanding, at a proteome level how, HPP exerts its effects on quality.

- Influence of different HPP treatment levels were observed with lower pressure (200MPa) being more appropriate than higher for meat.
- Higher pressure (600MPa) appeared to be more relevant for processing vegetables.

- Industry was positively disposed towards the availability of a HPP central treatment facility.

Main Results

- Mild pressure treatments minimally influence meat quality while improving meat hygiene.
- While high pressure levels would promote lipid oxidation, mid-range levels had no impact on fatty acid profile.
- Results suggest that increases in pressure result in increased precipitation of sarcoplasmic proteins onto myofibrils.
- Processing at 600MPa and blanching were the treatments that best preserved the antioxidant capacity of vegetables.
- The enhanced nutritional profile of the chilled ready meal concept garnered higher levels of consumer acceptance especially amongst respondents in the family life stage.
- The overall result from the 300 consumer acceptance tests, indicated that a pressure treatment of 200 MPa was most acceptable to the majority of consumers.
- Further education and technical training is warranted to increase industry awareness of HPP.

Opportunity/Benefit

This project provides valuable information for scientific and consumer audiences and provides a good starting point for further research or development by others, including industry. As a non-thermal treatment which can influence microbial safety, HPP holds potential as a minimal process technology of relevance to the production of ready to eat meat products which are microbiologically safe and possess superior sensory and nutritional attributes. Expressions of interest in further developing this research are welcome.

Collaborating Institutions

University College Cork

Project Number: 5580

Funding Source: DAFF (R&D/TAFRC/521)

Date: March, 2012

Project Dates: Nov 2006 – Jun 2010

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UPDATE

Development of a Highly Functional Cheese Sauce

Key External Stakeholders

Dairy Industry, Food Manufacturers.

Practical Implications for Stakeholders

- Ultra High Temperature (UHT) and *sous vide* cheese sauces were developed.
- A new process to create concentrated cheese flavours was developed. This new process allows a diverse range of concentrated cheese flavours to be developed from base dairy substrates.
- In addition a spray dried concentrated cheese flavour was also production and information as to minimize losses of volatile key flavour compounds was highlighted.

Main Results

- A method for producing retort cheese sauces.
- Novel method for the production of concentrated cheese flavours.
- A greater understanding of the flavour potential and use of dairy cheese lactic acid starter bacteria in the production of concentrated cheese flavours.
- How manipulation of pH can impact on losses of key volatile cheese flavour compounds during spray drying.
- How manipulation of pH can impact on sensory perception.

Opportunity/Benefit

Consultancy and contract research opportunities are available to both national and international clients in the area of enzyme-modified cheese and concentrated cheese flavours.

A HPLC method to quantify short chain volatile free fatty acids was developed and is now available as a technical service to industry.

A detailed one-two day course on all aspects of enzyme-modified cheese has been developed and is available to industry on request.

Collaborating Institutions

N/A

Project number: 5115

Date: May, 2011

Funding source: DAFF 01/R&D/TD/189

Project dates: July 2003–June 2006

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UPDATE

Development of Food Ingredients for Modulation of Glycaemia

Key External Stakeholders

Ingredient suppliers, nutritional beverage manufacturers.

Practical Implications for Stakeholders

This research provides scientifically validated knowledge on how to combine dairy proteins and carbohydrates for controlled structure development and glucose release in foods. This included studying the effect of the interaction between carbohydrates and dairy proteins on viscosity development and susceptibility to enzymatic hydrolysis and explored the possible modulating effects of dairy proteins, i.e. alpha(α)-casein, beta(β)–casein, beta(β)-lactoglobulin & alpha(α)-lactalbumin on the gelatinisation characteristics and related functional behaviour of starch (waxy maize) in food formulations.

We found that it is possible to develop different physical properties in solution due to the interactive effects of varying combinations of carbohydrates (konjac glucomannon, starch, maltodextrin and inulin) and proteins (alpha(α)-casein, beta(β)-casein,

alpha(α)-lactalbumin and beta(β)-lactoglobulin). Rheological analysis demonstrated that under suitable gelling conditions;

- Inulin had little effect on the gel-strength of β-lactoglobulin compared to konjac glucomannon.
- Konjac glucomannon enhances gelling properties.
- Adding maltodextrin to starch in solution results in higher viscosity than starch alone during pasting and the gelatinisation profiles of starch alter when maltodextrin is present.

Main Results

- Inulin had little effect on the gel-strength of β-lactoglobulin compared to konjac glucomannon which enhances gelling properties.
- The gelatinisation profiles of starch alter when maltodextrin is present, e.g. the addition of maltodextrin to starch in solution results in higher viscosity than starch alone during pasting.
- It is hypothesised that gelatinisation of starch in structured casein networks provides a method for decreasing the digestion rate of the starch and can thus contribute to modulation of postprandial glucose fluctuations.
- Different proteins, in particular α- casein and β-casein, have different abilities to alter the viscosity and subsequent glucose release of food systems.
- Caseins reinforce the structure of starch granules during gelatinisation.

Opportunity/Benefit

The combination of different proteins and selected carbohydrates creates new opportunities for developing functionality in dairy based beverages. The project can contribute to the development of nutritional formulations designed for sports and/or medical applications such as patients with Type 2 diabetes and/or glucose intolerance. Expressions of interest in accessing or furthering this research are welcome.

Collaborating Institutions

University College Cork

Project number: 5590

Funding source: DAFF (06/R&D/TMFRC445)

Date: October, 2011

Project Dates: Sep 2006 – Nov 2010

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UPDATE

Development of Healthier Meats and Meat Products

Key External Stakeholders

Meat processors, retailers, ingredients companies, consumers.

Practical implications

The outcomes of the research from this project deliver know-how to the Irish meat industry on how to develop innovative, healthy, value-added meat products of high nutritional and sensory quality. Also, the research enables Irish meat processors to make significant inroads into the functional food market and increase Irish competitiveness in this area.

Main Results

- The effect of the plant extracts Lutein, Sesamol and Ellagic acid on quality parameters in raw and in cooked beef and pork products was investigated.
- Lutein, Sesamol and Ellagic acid reduced lipid oxidation in raw and cooked beef.
- Sesamol and Ellagic acid did not affect textural properties of cooked beef patties.
- Lutein enhanced textural properties of cooked beef patties.
- Sensory properties of cooked beef patties were unaffected by plant extract addition.
- Quality and sensorial properties in cooked sliced beef were unaffected by Lutein and Sesamol addition (via injection).
- Plant extracts reduced levels of lipid oxidation in sliced cooked beef stored aerobically and in MAP.
- Lutein and Sesamol increased sliced beef tenderness (instrumental and sensory).
- Plant extracts reduced lipid oxidation in raw pork patties.
- Lutein and Ellagic acid did not affect instrumental textural characteristics.
- Sesamol positively influenced textural characteristics of cooked pork patties.
- Sensory parameters were unaffected by plant extract addition.
- Sesamol and Ellagic acid reduced lipid oxidation in raw and cooked pork sausages.
- Sesamol increased the water holding capacity of raw pork sausages.
- Lutein and Ellagic acid positively influenced instrumental textural characteristics of cooked pork sausages.
- Sensory properties of cooked pork sausages were unaffected by plant extract addition.
- Colour and lipid stability cooked ham were unaffected by plant extract addition.

Opportunity/Benefit

Irish meat processors can increase the desirability of their products to consumers by using natural plant extracts in place of synthetic additives. They could also create new markets by developing functional meat products using plant extracts.

Collaborating Institution

University College Cork

Project number: 5424

Funding source: DAFM 04/R&D/C/236

Date: April 2014

Project Dates: Jan 2005 – Dec 2008

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UPDATE

Development of High Protein Bars as Vehicles for Functional Ingredient Delivery (PROBar)

Key External Shareholders

Dairy ingredient manufacturers, nutritional food formulators.

Practical Implications for Stakeholders

- The shelf stable nature of high protein bars is largely attributable to the their controlled water activity (a_w) which creates an environment that limits the activity of spoilage microorganisms.
- Probiotic microorganisms are equally affected by such controlled a_w levels, hence this study aimed to understand how probiotic cultures such as *L. casei* may be adapted to survive when carried in a protein bar matrix. Strain adaptability was established by exposing the culture to variation in relative humidity (%RH) especially if incorporated with a prebiotic FOS/GOS mixture. Additional protection is afforded if skim milk is included in the preparation.
- Incorporation of hydrolysed protein (WPH) in bar formulations favours higher initial counts of *L. casei* (<24h) but does not sustain the initial momentum during subsequent storage at 20°C

- Dispersal of *L. casei* in combination with a mixture of FOS-GOS and skim milk in molten chocolate prior to bar formulation provides an effective protective medium.
- Significantly better probiotics protection was afforded when co-blended with the prebiotic mixture, FOS/GOS, and dispersed in larger chocolate pieces as well as chocolate coating.

Main Results

- A high protein bar system incorporating ingredients in an experimentally-designed formulation study was used to monitor the survival added probiotic cultures.
- Advanced analysis by means of flow cell cytometry indicated that a significant proportion of the apparently 'dead' probiotics cells following storage may be capable of revival.

Opportunity/Benefit

A novel protocol by which probiotics may be added to high protein bars and their viability maintained during bar storage is outlined. Further extended storage tests are recommended in follow-up studies to validate the findings of this time-constrained project.

Project number: 6611

Funding source: FIRMplus / DAFM (13/F/513)

Date: May, 2015

Project Dates: Dec 2013 – April 2015

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UPDATE

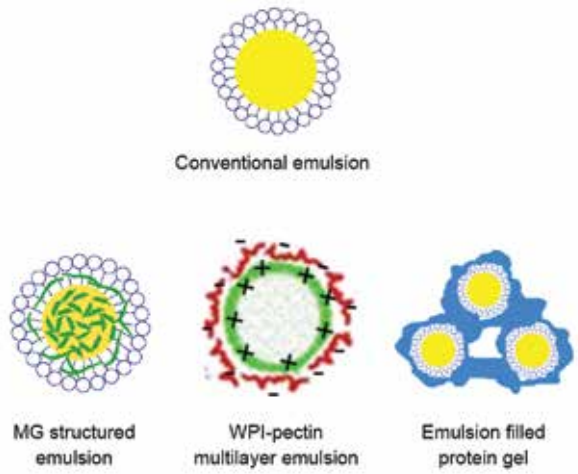
Development of Novel Food Structures Which Deliver Engineered Flavour and Health Benefits

Key External Stakeholders

Dairy and beverage industry, manufacturer of fat-reduced foods, academic and research institutes.

Practical Implications for Stakeholders

The study provided important information about different structured emulsions as delivery systems for flavour compounds, and on how food structure can be designed to modulate flavour release. The findings suggested that it is possible to modulate flavor release (response to different triggers) by changing emulsion structure, which could be helpful in the development of functional foods with improved flavour profile. The emulsions studied in this research many also find applications to deliver non-volatile functional ingredients.



Main Results

- Monoglyceride formed liquid crystalline structures in the oil phase of oil-in-water emulsions, and crystalline structure worked to reduce the amount of flavour released to the headspaces.
- Headspace concentration of flavours was significantly lower in WPI-pectin multilayer emulsions than that in conventional emulsions and flavour release can be modulated by adjusting pH, salt concentration of the emulsion.
- Flavours had lower release rates and headspace concentrations in emulsion filled protein gels, and the release was more inhibited when more protein was included. Reduced flavour release in oil-reduced gels can be achieved by increasing WPI content.
- The involvement of matodextrins in the emulsions improved emulsion stability against freeze-thawing, and flavours had similar release profiles before and after freeze-thaw treatment.

Opportunity/Benefit

This research provides profound knowledge about emulsion structures and flavor release, and the designing of flavor delivery systems. Different structured emulsions with structuring of the oil phase, water phase, and interface allow better delivery of food flavors and other functional ingredients. The findings obtained in this study provided important information on designing novel food products with specific health/function claims and improved flavor profile, e.g., fat reduced food, long shelf-life foods.

Collaborating Institutions

University College Cork

Project number: 5991

Funding source: Teagasc

Date: March, 2015

Project dates: Oct 2010 – Dec 2014

How to Proceed

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UPDATE

Early Detection of Mushroom Bruising Using Imaging Technology

Key External Stakeholders

Mushroom producers, mushroom packers, supermarket chains.

Practical Implications for Stakeholders

- The capability to identify damaged mushrooms before browning becomes visible has been developed.
- The technology has the potential to reduce acceptance problems for mushroom lots at both wholesale and retail level.

Browning of mushrooms because of damage during harvesting and transportation results in a monetary loss for the mushroom industry. This project investigated the use of a rapid, non-destructive system, near infrared (NIR) spectroscopy and hyperspectral imaging (NIR-HSI), which has the potential to identify the damaged mushrooms before browning is visible. The technique is capable of on-line installation and operation and could eventually be deployed for screening of sample or whole lots.

Main Results

- Conventional NIR spectroscopy can discriminate between damaged and undamaged mushrooms with almost 100% accuracy.
- Conventional NIR spectroscopy is capable of predicting post-harvest age in damaged and un-damaged mushrooms with a high level of accuracy.
- NIR–HSI can discriminate between damaged and undamaged mushrooms within 1 day of harvest at rates of 72 and 86% respectively.

Opportunity/Benefit

Expressions of interest from mushroom producers or distributors relating to exploitation of this emerging technology through engagement with Teagasc are welcome. Teagasc can develop turnkey applications for interested companies on request.

Collaborating Institutions

Dublin Institute of Technology, University College Dublin

Project Number: 5708

Funding Source: DAFF (06/R&D/DIT487)

Date: February, 2011

Project Dates: Nov 2006- Jul 2010

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UPDATE

Emerging Verocytotoxigenic *Escherichia coli* (VTEC) on Irish Beef Farms

Key External Stakeholders

Irish beef farmers, beef processors, FSAI, DAFF, public health personnel, epidemiologists and scientists interested in VTEC research.

Practical Implications for Stakeholders

This study discovered that VTEC were widespread on Irish beef farms and some serotypes were capable of causing serious illness in humans. A range of different VTEC serotypes were also detected on cattle hides and carcasses in the abattoir. New, more virulent serotypes are emerging and will join *E. coli* O157 in causing serious disease outbreaks in the future.

Main Results

- VTEC are widespread on Irish beef farms.
- VTEC are present on hides and carcasses in the abattoir.
- VTEC survive well in Irish clay and sandy soils.
- Several serotypes of potential clinical significance are emerging.

Opportunity/Benefit

The data generated, especially on non-O157 VTEC will be used to formulate new risk based meat inspection procedures and in the development of public health protection policy. It strongly supports the case for expanding current microbiological criteria in meat monitoring and identifies novel VTEC that should be tested for in seriously ill patients not infected with O157.

Collaborating Institutions

University College Dublin; University of Ulster, Jordanstown; US Department of Agriculture-ARS

Project Number: 5554

Funding Source: FIRM (06/R&D/TN/357)

Date: October, 2011

Project Dates: Oct 2006 – Sep 2009

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UPDATE

Engineering of High Quality Gluten-Free Breads

Key External Stakeholders

Food manufacturers, bakeries, food ingredients companies.

Practical Implications for Stakeholders

A number of recent studies highlighted the poor nutritional quality of gluten-free cereal-based products available on the market. This project evaluated the baking and nutritive properties of the pseudocereals amaranth, quinoa and buckwheat, and their applications as functional ingredients in a gluten-free bread formulation.

The pseudocereal flours proved to be extremely viable and should play an important part in enhancing the nutritional properties of gluten-free breads. This gluten-free project has further improved the knowledge and expertise of the cereal group at Ashtown in this significant and ever-growing area. In summary:

- Pseudocereal flours are feasible ingredients in the formulation of good quality gluten-free breads.
- Pseudocereals are important energy sources, due to their starch content, and contain good quality protein, dietary fibres and lipids rich in unsaturated fats.
- Pseudocereals have adequate levels of important minerals such as calcium and iron.

Main Results

- Buckwheat and quinoa breads had increased bread volume.
- Pseudocereal containing breads had a softer texture than the control bread.
- Higher levels of protein, fat, fibre and minerals were found in the pseudocereal breads.
- Buckwheat breads had the highest total phenol content.
- Quinoa and buckwheat grains are rich sources of polyphenols.
- Amaranth, quinoa and buckwheat breads are excellent sources of vitamin E.

Opportunity/Benefit

The opportunity exists to engage with Teagasc to produce a range of nutritionally enhanced gluten-free breads using the tested pseudocereals which may provide interested companies with a competitive advantage. Companies can access the expertise gained through services provision, with the potential also to engage in research with Teagasc researchers in order to develop these products successfully.

Collaborating Institutions

University College Cork

Project Number: 5472

Funding Source: DAFF (FIRM) & EI

Date: June, 2011

Project Dates: Mar 2006 – Mar 2009

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UPDATE

Exploitation of Cheese Cultures for Flavour Diversity and Functionality

Key External Stakeholders

Dairy industry, starter supply companies, research community.

Practical Implications for Stakeholders

Microorganisms are critical for cheese manufacture and ripening and are a key contributor to its flavour development. Thus, application and control of the cheese microbial flora during manufacture and ripening offers the cheese manufacturer a means to develop cheeses with flavours and functionalities targeted to specific markets. This project was sought to determine the impact of various microorganisms on cheese flavour and functional properties with a view to identifying strains with beneficial traits that could be exploited by the industry.

The main issues addressed included investigations into:

- The potential of exopolysaccharide (EPS) producing starter to cheese manufacture and ripening.

- The contribution of *Streptococcus thermophilus* to Cheddar cheese flavour.
- Identification of new bacterial strains for cheese manufacture.

Main Results

- A bank of 142 EPS producing lactic acid bacteria was assembled.
- It was clearly demonstrated that EPS producing strains have the capacity to improve cheese yield and enhance the texture properties of reduced-fat Cheddar cheese.
- *St. thermophilius* when used as a starter or starter adjunct impacted on flavour development in a strain specific manner.

Opportunity/Benefit

The successful implementation of this project provides a range of options to cheesemakers to produce cheeses with improved and diverse flavours and functional properties. By so doing the project supports the efforts of Irish cheese makers to exploit markets for cheese with diverse and unique flavours, such as the speciality and extra mature Cheddar markets in the UK, to which only limited access is currently available. Expressions of interest from companies interested in this area are welcome.

Collaborating Institutions

University College Cork

Project Number: 5431

Funding Source: DAFM (04/R&D/TD/309)

Date: March, 2012

Project Dates: Jan 2005 – Sep 2009

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UPDATE

Exploration of Irish Meat Processing Streams for Recovery of High Value Protein Based Ingredients for Food and Non-Food Uses

Key Stakeholders

Meat sector, food (human and pet), beverage, protein processors, sports, nutrition, biomedical, cosmetics.

Practical Implications for Stakeholders

Recovery of high value protein-rich functional co-products from meat processing streams represents an area of significant opportunity to enhance the economic performance and improve the environmental impact of the Irish meat Industry. ReValueProtein will capitalize on many potential opportunities to valorise meat processing secondary, by-product or waste streams. As there is no Irish based strategic initiative to support this exploitation, there is a pressing requirement for a nationally funded effort to support the meat industry in capitalizing on this opportunity. ReValueProtein is an ambitious project which brings together a multidisciplinary team [food chemistry, biosciences, tissue engineering, process (novel and pilot scale) technologies, consumer science, food and beverage technology] to generate technical know-how to develop functional co-products with applications in food, beverage, health and biomedical engineering. Intellectual property, protocols and products

generated will have relevance across all of these sectors.

The main activities fall under **three key scientific pillars:**

I. **Characterization** of source materials (offal, blood, trim etc), extracts and novel products;

II. **Processing** of source materials to generate products (including assessment of novel process technology and working up to pilot scale production);

III. Evaluation of **applications**: techno-functional (emulsification etc), health promoting, bioactive, bioavailability, tissue engineering etc.

All of these are underpinned by analysis of consumer attitudes and preferences pertaining to sustainable processing and the products generated.

Main Results

Assessing processing technologies which are of relevance for the recovery of functional proteins from low, neutral or negative value products.

Proteins exhibiting techno-functional (emulsification) properties recovered from bovine offal.

Other raw materials reviewed with a view to extracting or generating high value functional proteins or peptides.

Opportunity/Benefit

Recovery of value from meat processing streams holds strong potential for the meat sector to generate higher value products from existing low/neutral value products. These higher value products can have applications in a variety of arenas such as the food and beverage (emulsifiers, binders, flavour etc), sports/nutrition, biomedical (bioactive peptides, collagens for wound repair) sectors.

Collaborating Institutions

University College Cork, University College Dublin, NUIGalway, Tralee IT/Shannon ABC

Project Number: 6430

Funding Source: DAFF 11F043

Date: April 2014

Project Dates: March 2013 – Feb 2018

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UPDATE

Food Solutions for Weight Management

Key External Stakeholders

Dairy Industry, Food manufactures, Consumer.

Practical Implications for Stakeholders

Teagasc, under the Food for Health Ireland (FHI) umbrella, is striving to deliver foods that enhance satiety.

- Ingestion of such foods may reduce portion size and/or frequency leading to a reduction in food intake over time.
- The aim is to identify ingredients that 'make you feel fuller for longer'

FOOD FOR HEALTH IRELAND

Main Results

- 1000 dairy fractions were screened in high throughout satiety assays *in vitro.*
- Of these, eleven lead functional compounds were identified; eight activating satiety receptors in the brain and three increasing satiety hormone secretion in the intestine.
- Three of these 'leads' have been proven to reduce food intake over time in animal trials.
- Successful scale up to 100litres has occurred with at least one lead functional compound.

Opportunity/Benefit

- We have identified eleven milk derived ingredients that enhance satiety.
- These ingredients can potentially be used by the food industry in weight management/slimming products.
- An economical viable scaled up satiety enhancing ingredient with strong scientific data benefits the consumer in the 'battle of the bulge'
- A major achievement has been the establishment of high throughput bioassays for satiety and adiposity which are now available as a compound screening platform to industry.

Collaborating Institutions

UCC, UCD, UL, DCU under the FHI umbrella www.fhi.ie.

Project number: 5942

Date: Oct, 2014

Funding source: Enterprise Ireland *Grant Number CC20080001*

Project dates: Nov2009-Oct2013

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UPDATE

Fruit and Vegetable Waste: Source of Molecules to Control Plant Pathogen *Ralstonia Solanacearum*

Key External Stakeholders

Fruit and vegetable growers/processors, beverage industries, environmental protection agency, pharmaceutical companies, research communities, policymakers.

Practical Implications for Stakeholders

- The bacterium *Ralstonia solanacearum* is a widespread soil-borne plant pathogen that causes lethal wilting disease in >200 plants including economically important crops (e.g. potato, tomato, tobacco, banana) and flowering plants.
- A carbohydrate-binding protein *Ralstonia solanacearum* Lectin (RSL) is involved in the attachment of bacteria to cell walls in the plant host.
- Inhibitors, which block the active site of RSL will reduce/eliminate the interaction between Ralstonia and plant hosts.

- Fruit and vegetable processing waste can serve as a potential source of natural inhibitor molecules for RSL.

Main Results

- Simple water extracts from vegetables (tomatoes and carrots) showed sugar molecules that bind to *Ralstonia solanacearum* Lectin (RSL) – a protein present in plant pathogen *Ralstonia solanacearum*. NMR spectroscopy data suggested that these sugar molecules are largely mannosides.
- Interactions of RSL and crude extracts rich in polyphenols were also observed, however subsequent fractionated polyphenol extracts did not show interaction. This proved that the sugar molecules are ideal candidates to bind RSL.
- Synthetic sugar (fucosylated) polymer obtained from Durham University , UK, has shown strong binding to RSL, equivalent to commercial methylated fucose monomer.

Opportunity/Benefit

Outcomes of this project show new food by-products or underutilised plants such as seaweeds are rich in fucoidans that can be used as a biocontrol of *Ralstonia solanacearum.* Developing natural pesticides in this manner is advantageous with the end-product is likely to be non-toxic to animals and biodegradable resulting in minimal environmental impacts.

Collaborating Institutions

NUI Galway

Project number: 6272

Funding source: Teagasc

Date: November, 2015

Project dates: Oct 2011 – Oct 2015

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UPDATE

Functional Beverages Containing Health-Promoting Prebiotic Milk Oligosaccharides

Key External Stakeholders

IMF manufacturers, dairy/cheese industry, dairy farmers.

Practical Implications for Stakeholders

- In addition to known bovine milk oligosaccharides, detection of 18 new high-molecular weight oligosaccharides was observed in the enriched powders.
- Kg quantities of powders enriched in milk oligosaccharides can be produced using the developed membrane filtration process.
- The oligosaccharide powders produced have been shown *in vitro* to possess prebiotic activity and can prevent invasion of human cells by *Campylobacter jejuni*.

- The oligosaccharides powders also decreased number of potential pathogens *in vivo* in a mouse model.

Main Results

- In this study, pilot-scale enrichment of oligosaccharides from whey streams using 1 kDa membranes was successful yielding as high as 17.52% enrichment of oligosaccharides as a % of lactose.
- This study revealed, for the first time, the presence of several new free oligosaccharides containing up to 10 monomers that correspond in size to the most abundant oligosaccharides present in human milk including some fucosylated structures.
- A variety of bioactivities were shown to be associated with the bovine oligosaccharides *in vitro* such as increased colonization of human intestinal cells by Bifidobacteria, prebiotic effects and anti-invasive activity against Campylobacter.
- Bovine milk oligosaccharides were found to reduce non-beneficial or pathogenic bacterial populations *in vivo* in the mouse GIT and have no adverse effects on the other health parameters measured.

Opportunity/Benefit

The technologies to enrich oligosaccharides in this work are based on membrane filtration techniques. The membranes are already well established in the dairy industry and depending on the extent of use of an existing plant, it is anticipated that little additional costs would be required in terms of plant, personnel and training investment. Furthermore, bearing in mind the potential applications of oligosaccharides if produced by such industries, the initial capital and production costs would be spread between different high value-added ingredients for diverse applications.

Collaborating Institutions

UC Davis

Project number: MD-BY-5551/Dairy Levy 5450

Funding source: DAFM, Dairy Levy

Date: November 2015

Project dates: March 2006 – May 2012

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UPDATE

Functional Properties of Beta-glucans from Barley

Key External Stakeholders

Food manufacturers, bakeries, food ingredients companies.

Practical Implications for Stakeholders

- Barley fractions are feasible functional ingredients that can be used in the formulation of yeast breads of a high baking, sensory and nutritional quality.
- Barley middlings, considered a by-product or waste stream, contain high levels of beta-glucan and were successfully used to produce viable bread products that may have potential for commercialisation.

Past studies have shown barley to be an excellent source of dietary fibre and beta-glucan, a polysaccharide that when consumed regularly has important health benefits including reducing the risk of heart disease. This project studied a variety of barley cultivars and evaluated their use as low cost, high beta-glucan-containing functional ingredients. Optimisation of milling procedures generated a range of milled barley fractions that were

then blended with wheat flours and used in bread formulations which were evaluated for their rheological, textural and nutritive properties.

Main Results

- A range of new and nutritious barley fractions were isolated by optimising the milling process.
- Barley middlings were found to be an important source of beta-glucan and can be used in the formulation of bread products.

Opportunity/Benefit

The opportunity exists for bakers, ingredient companies and other relevant industry personnel to link with Teagasc in order to optimise milling conditions, formulate flour blends and develop functional bread products with enhanced levels of dietary fibre and beta-glucan.

Collaborating Institutions

University College Cork, Cork Institute of Technology, University College Dublin

Project number: 5715

Funding source: DAFF (06/RD/C/462)

Date: June, 2011

Project Dates: Sep 2006 – Sep 2010

How to Proceed

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UPDATE

FUNLAC: Lacticin-Based Ingredients for Biopreservative and Functional Food Applications

Key External Stakeholders

Food producers.

Practical Implications for Stakeholders

- A genome sequence of the lacticin producing strain was completed, which allows identification of genes relevant to industrial and food safety applications. This genetic blueprint can additionally be used to identify and exploit other interesting traits (both fundamental and commercial) associated with the strain.
- A *Lactococcus lactis* strain identified as producing elevated antimicrobial activity was investigated. This is of relevance to the food industry given that the use of this strain results in elevated lacticin 3147 activity at no additional cost, thereby improving commercial value and impacting on the use of the antimicrobial lacticin 3147 in food industry applications.
- When assessed *in vivo*, lacticin 3147 was found to be degraded within the gastrointestinal tract by the enzyme a-chymotrypsin. Thus, lacticin 3147 was deemed safe for ingestion, given that it would not impact negatively on commensal gut flora. Additionally, the fact that lacticin 3147 is effective in the oral cavity provides the opportunity to influence dental health through the development of oral food applications.
- Lacticin 3147 has been demonstrated to be a robust antimicrobial with the ability to control food spoilage and pathogenic bacteria in non-dairy-foods. It was found to be particularly effective for the control of *Bacillus cereus* on beansprouts, with results indicating that it is more effective than the conventional hypochloride solutions, currently used.

Main Results

- The genome sequence of the lacticin 3147 producing strain was completed.
- In one of the first reports of its kind, where a lantibiotic was assessed *in vivo*, lacticin 3147 was found to be degraded within the gastrointestinal tract by the enzyme a-chymotrypsin. Thus, lacticin 3147 was deemed safe for ingestion.
- Lacticin 3147 was demonstrated to be a robust antimicrobial with the ability to control food spoilage and pathogenic bacteria in non-dairy foods.

Opportunity/Benefit

Lacticin 3147 has been demonstrated to be effective against all Gram positive bacteria tested to date, and has a free from additive status. It is a natural antimicrobial that could be the solution to a broad range of microbial problems for food producers in food biopreservation and shelf life extension applications, as well as having potential for biomedical applications. Expressions of interest are welcome from such companies to optimise this technology with a view to licensing.

Collaborating Institutions

University College Cork

Project Number: 5363

Funding Source: DAFF (04/R&D/TD/317)

Date: December, 2010

Project Dates: Oct 2005 – Aug 2009

How to Proceed

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UPDATE

Genetic Tools for Improvement of Food Cultures

Key External Stakeholders

Starter culture suppliers, fermented dairy food producers, dairy research community.

Practical Implications for Stakeholders

- A food-grade cloning system for application in food safety and food quality arena.
- A system where genes for key metabolic and industrial traits can be under-/over-expressed.
- Characterisation of the phage resistance determinants for food-grade improvement of starter cultures.
- Identification of the PyrR gene as a target for the development of bacteriophage resistance strategies in starter cultures.

Main Results

- We overexpressed the plasmid-borne Mg^{2+}/Co^{2+} transporter and investigated its potential as a marker gene for direct insertional inactivation in lactococci.
- We identified the genetic determinants involved in phage resistance in the conjugative lactococcal plasmid pMRC01.
- We identified the *pyrR* gene as a potential target for improvement of phage resistance properties in starter cultures.

Opportunity/Benefit

The use of recombinant food cultures requires a food-grade approach to the design of systems for their genetic manipulation. The Genetic Tools for Improvement of Food Cultures program focused on the development of safe and sustainable genetic manipulation systems for various food-grade fermentative and probiotic bacteria. Given that the ultimate aim of research on the biotechnology of food cultures has been to genetically improve strains for food use, much of the focus in recent years has been on the development of self-cloning systems, which rely on genetic elements naturally occurring in the genus. However, the presence of inherent background resistances associated with many of these food-grade markers has placed limitations on their use, something we address in this project. Additionally the wealth of genomic data and information available can be viewed as a positive resource and can be mined for gene-finding strategies.

Collaborating Institutions

University College Cork, Cork Institute of Technology

Project number: 5027

Date: Spring 2014

Funding source: Teagasc

Project dates: March 2001 – Dec 2007

How to Proceed

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UPDATE

Genomic Analysis of *Lactobacillus helveticus* DPC4571

Key Stakeholders

Dairy industry, starter supply companies, research community.

Practical Implications for Stakeholders

Bacteria used in the manufacture of cheese play a major role in determining the flavour of the final product. The capacity to direct cheese flavour development to address specific consumer desires, through the use of such bacteria, offers the cheese manufacturer a significant advantage in the market place. Previous research at Teagasc has demonstrated that the use of *Lactobacillus helveticus* in cheese manufacture results in cheese with a very desirable sweet, nutty flavour. This project sought to use molecular biological approaches to gain a greater understanding of *Lactobacillus helveticus* and its role in cheese flavour development.

The main focus of the research was:

- Generation of the first complete genomic sequence of *Lactobacillus helveticus.*
- Exploitation of the genomic data to gain a greater understanding of the manner in which this bacterium impacts on cheese flavour development.

Main Results

- The complete genomic sequence of *Lactobacillus helveticus* DPC4571 was assembled and analysed.
- Four genes with the potential to impact on cheese flavour were examined using molecular approaches.
- Molecular tools for the further genetic manipulation of *Lactobacillus helveticus* were developed.

Opportunity/Benefit

This project resulted in the first published genome sequence of a *Lactobacillus helveticus* strain, thus providing a complete overview of the metabolic capabilities of what is a very successful cheese-making bacterium. The successful completion of the project has provided an insight into how this bacterium impacts on cheese flavor development during ripening and this has enabled selection of additional strains that can impact successfully on cheese flavor development. By doing so, the project supports the efforts of the Irish cheese makers to exploit markets for cheese, in particular cheeses with sweet, nutty flavours that are highly prized by the modern cheese consumer. Expressions of interest from companies involved in this area are welcome.

Collaborating Institutions

University College Cork

Project Number: 5434

Funding Source: DAFM 04/R&D/TD/311

Date: June, 2012

Project Dates: Sept 2005 – Oct 2009

How to Proceed

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UPDATE

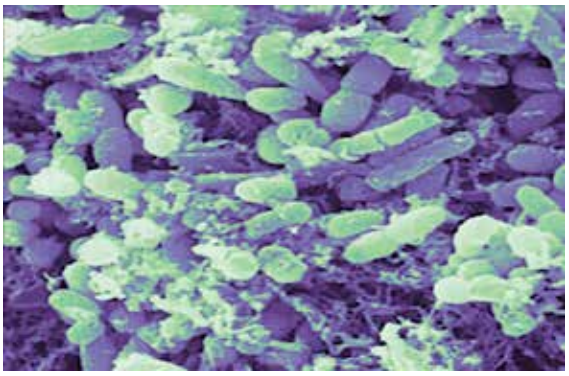
Genomics of Gram Negative Food Poisoning Bacteria of Animal Origin

Key External Stakeholders

Food sector (pork sector in particular), Regulators, Food Safety Authority of Ireland.

Practical Implications for Stakeholders

Approximately 40% of Salmonella *Typhimurium* isolates examined, readily attached to food contact surfaces and formed biofilms (bacterial populations on surfaces). In biofilms, *Salmonella* can persist for long periods of time, and pose a risk of contamination in food production. Research showed that particular genes and proteins needed to be expressed to allow formation of biofilms by *Salmonella*, and these could be targeted in the development of new biocides.



Main Results

- Of the *Salmonella* Typhimurium isolates (n=172) examined, which were recovered from the pork chain in Ireland or of human clinical origin, about 40% had the ability to form biofilms on stainless steel and plastic surfaces. Among clinical isolates, 73% attached to PVC plastic compared to 53.3% of pork isolates. This indicates that the ability to persist on surfaces may be enhancing the transmission of *Salmonella* through the food chain to the consumer.
- *Salmonella* in biofilms formed at pH 5 showed increased expression of virulence genes *hilA* and *invA* compared to those from biofilms formed at neutral pH 7. This indicates that acidic environments in food production plants may enhance the ability of *Salmonella* to cause food borne illness.
- In acidic environments, genes related to *Salmonella* motility i.e. flagella structures (*Flagellin*) were down-regulated in cells from biofilms as compared to non surface attached (planktonic) cells. Genes related to cell-to-cell signaling and transport of exopolysaccharides across the outer membrane, were up-regulated and needed for successful biofilm formation. Proteomic analysis also revealed that the switch from planktonic to biofilm status required up-regulation of proteins associated with glycolysis, cell-to-cell signaling and protein transport.
- The design of biocidal agents that specifically interfere with glycolysis and cell-to-cell signaling and that enhance flagella formation could help inhibit biofilm formation by *S*. Typhimurium in food processing facilities.

Opportunity/Benefit

The data generated in this project gives a fundamental understanding on the persistence and biofilm formation by *Salmonella* on contact surfaces used in food production. This information may support industry in the control of this pathogen and the development of novel targeted biocidal agents.

Collaborating Institutions

University College Dublin

Project Number: 5854

Funding Source: DAFF (06/TNI/UCD/10)

Date: September 2013

Project Dates: Nov 2007 – Dec 2012

How to Proceed

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UPDATE

GLYCO-PROSPECTING: For Health Promoting Activity

Key External Stakeholders

Food manufacturers, dairy industry, pharmaceutical companies, research communities, public health agencies and health professionals and policymakers.

Practical Implications for Stakeholders

- A major research focus has moved to identify components of bovine milk which, when isolated or concentrated, can bring added value to applications such as infant formula.
- Irish dairy research in particular is expanding in this area due to the large increase in milk volumes following the abolition of milk quotas.
- In particular, research on the complex carbohydrate structures which are inherent in bovine milk is gaining momentum.
- In the case of bovine milk glycoproteins, the larger molecular weight of these components and the more diverse chemistries facilitates ease of purification.
- Here, the importance of the glycans on such proteins, structural changes that may occur and their relevance to the functionality of the intact glycoprotein is explored.

Main Results

- More diverse complex-type oligosaccharides structures are present on lactoferrin during early lactation with an abundance of oligomannose type glycans in later lactation.
- Novel interactions were identified for *C. sakazakii, S. pneumoniae* and *P. aeruginosa* with the highest binding observed for mature milk lactoferrin in all cases, with the exception of *S. typhimurium*. The interaction between lactoferrin and these pathogens may imply a role as decoy receptors to which pathogens bind to instead of to host cells.
- Glycomacropeptide (GMP), a 64 amino acid peptide, derived from k-casein, was also selected given the current interest in this glycopeptide as a prebiotic. GMP promoted the growth of *Bifidobacterium longum* subsp. *infantis*. Transcriptional analysis of *B. infantis* following exposure to GMP revealed a substantial response to GMP relative to the controls (no GMP and GMP with disrupted glycans). These results suggest that the *O*-linked glycosylation of GMP is intrinsic to the growth stimulation of *B. infantis*.

Opportunity/Benefit

Overall, this research adds to our understanding of the structural and functional importance of milk protein glycosylation. It also highlights the potential of these compositionally complex molecules as ingredients which can be exploited by the food and pharmaceutical industry.

Collaborating Institutions

Glycoscience Group, National Centre for Biomedical Engineering Science, National University of Ireland Galway, Galway, Ireland.

Project number: 5975

Funding source: Core

Date: November, 2015

Project dates: Nov 2009 – Oct 2013

How to Proceed

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UPDATE

Health Promoting Bioactives from Cider Yeast

Key External Stakeholders

Food manufacturers, dairy industry, pharmaceutical companies, research communities; public health agencies and health professionals; policymakers.

Practical Implications for Stakeholders

Beta glucan is a bioactive polysaccharide which has FDA approval for the reduction of cardiovascular risk, the leading cause of death and morbidity in the EU. A cardioprotective diet enriched in dietary fiber, and in particular beta glucan is recommended to protect against the development of cardiovascular disease. Furthermore, food-derived ACE (Angiotensin-I-converting enzyme)-inhibitory peptides have been shown to reduce peripheral blood pressure and exert an antihypertensive effect *in vivo* following ingestion. In this project, bioactive components (ACE inhibitory/ antihypertensive peptides and beta glucan) were isolated and characterised from Natural Yeast, which was a by-product of the cider production process.

Main Results

- Laboratory scale trials, involving autolysis and hydrolysis of spent cider yeast, were optimised for production of yeast extracts, enriched in free amino acids, flavour-enhancing components and bioactive ACE-inhibitory peptides.
- Pilot scale trials were performed but further technical trials are required.
- Economic and financial analysis of the prototype products developed in this project were undertaken, and results indicated that the process for their production (involving spray drying at 20%) was not commercially viable, with further technical trials required to overcome this difficulty.

Opportunity/Benefit

The opportunity exists to further investigate the potential waste stream of Cider production in collaboration with industrial personnel. The research group benefited from improved links with industry (Cybercolors).

Collaborating Institutions

Cybercolors

Project number: 5932

Funding source: EI (IP/2007/0495)

Date: March, 2012

Project Dates: Nov 2008 – Oct 2010

How to Proceed

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UPDATE

Healthy Cereal-Based Snacks for the Elderly

Key External Stakeholders

Food manufacturers, bakeries, food ingredient companies.

Practical Implications for Stakeholders

It has been widely reported that undernutrition and malnutrition are widespread among the elderly in Europe, North America and other developed countries. Older people are unable to shop and cook properly to fulfill their nutritional needs. Barriers to healthy diets which have been identified include poor cooking skills, lack of motivation for shopping and poor housing conditions. As bakery products are commonly consumed (by people of all ages), and are widely available in local shops and supermarkets, they are obvious potential carriers for a range of functional ingredients directed towards health for the elderly. At the beginning of this project, a preliminary survey of existing snack-type products on the market revealed that no products were found that specifically targeted elderly consumers.

This project developed a range of healthy and novel baked and extruded products, which are convenient to eat, and targeted specifically at boosting the health of the elderly. The ingredients and formulations used in the project targeted specific areas of malnutrition in the elderly which have been highlighted in many current medical journals.

Main Results

The following products were developed and optimised:

- Low GI, enhanced fibre extruded/puffed corn-based snacks with a low density (therefore easy to eat).
- Soft, yeasted products containing resistant starch flours and increased fibre content.
- Breads containing sourdough, and either teff/sorghum flours (significantly reduced in vitro predicted glycaemic index).
- Cereal-based yoghurts with excellent nutritive and sensory properties.
- Scones/quickbreads with reduced fat and sugar, and having pre-and probiotic effects.
- Soft, semi-sweet baked products with extra fibre inclusions.
- Crumbly cookies/biscuits with enhanced fibre and protein levels.

Opportunity/Benefit

Following the use of ingredients and the development of a range of products during this project, advice, consultancy work and/or technical services can now be provided at Ashtown in this area through Teagasc's fee-paying service. Commercial trials are ongoing in the test bakery at Ashtown.

Collaborating Institutions

University College Cork

Project number: 5964

Funding source: DAFM

Date: November, 2015

Project dates: Dec 2008 – May 2014

How to Proceed

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UPDATE

Healthy Fatty Acid-Enriched Fresh Beef: Implications for Shelf-life and Flavour

Key External Stakeholders

Beef producers/processors, Bord Bia, Health professionals.

Practical implications

Strategies to manipulate the fatty acid composition of beef and the implications of the modified beef on shelf-life and flavour were examined.

- The findings will assist the beef industry in the production of beef with enhanced fatty acid composition from a human health perspective, and to prevent any associated deleterious effect on shelf-life or sensory characteristics of beef.
- The findings will also assist the marketing of Irish grass-produced beef.

Main Results

- Muscle lipids of pasture-fed cattle contained higher vaccenic acid, total and c9, t11- conjugated linoleic acid proportions than those from concentrate-fed cattle.
- Supplementation of pasture with plant/marine oils resulted in larger marginal increases in total and c9, t11- conjugated linoleic acid than supplementation of concentrate.
- The shelf-life of the modified beef was unaffected.
- The rather extreme dietary treatments had relatively small effects on shelf-life and sensory characteristics of beef.

Opportunity/benefit

The feasibility of producing beef with an enhanced fatty acid composition from a human health perspective, beyond that found in conventionally produced beef was demonstrated. The main challenge to industry is to develop a marketing strategy to capture this potential.

Collaborating Institution

UCD, University of Bristol, UK, MTT Finland

Project Number: 5409

Funding Source: DAFF (04/R&D/TN/243) & Teagasc

Date: July 2013

Project Dates: Oct 2005 – Mar 2009

How to Proceed

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UPDATE

Heart Friendly Foods

Key External Stakeholders

Food manufacturers, dairy industry, pharmaceutical companies.

Practical Implications for Stakeholders

- Dairy products enriched in soluble dietary fibre and beta-glucan, based on the use of novel adjunct food-grade cultures with soluble fibre – producing capacity during milk fermentation, were developed in this project. These cultures were also used as dietary adjuncts for *in situ* production of beta-glucan in the gut, and shown to exhibit cardioprotective properties.
- A cardioprotective diet enriched in dietary fibre, is recommended to protect against the development of cardiovascular disease. Dairy products are poor sources of soluble dietary fibre and beta-glucan, therefore, this represents an opportunity for the dairy industry to produce functional foods and dried dairy ingredients for protection against the development of cardiovascular disease, for functional and medical food markets.
- With cardiovascular disease being the leading cause of death and morbidity in the EU, and on the increase among the Irish population, the availability of such functional foods within the market would be of significant benefit to consumers and food producers alike.

Main Results

- Soluble fibre-producing food-grade cultures, including beta-glucan producing cultures from culture collections and novel sources were identified and characterised.
- *In situ* production of beta-glucan by food-grade cultures resulted in increased survival of the beneficial strain in conditions of elevated heat, simulated gastric juice, acid, bile and antibiotic stress.
- The low-fat yogurt developed with these adjunct strains exhibited superior functional properties compared to product manufactured without the cultures.
- Development of dried dairy ingredients and functional dairy foods enriched with soluble fibre and beta-glucan producing cultures with excellent rheological properties were developed.
- Efficacy was demonstrated against atherosclerosis development of selected soluble fibre and beta-glucan producing cultures in an animal model of lipid-driven atherosclerosis.

Opportunity/Benefit

The opportunity exists to further investigate the potential of microbially produced soluble fibre as a potent bio-active food ingredient and potential pharmaceutical product for human health benefit with a view to commercialisation. A patent application is in the process of being filed. Expressions of interest from relevant companies are welcome and opportunities to collaborate and license this technology can be discussed.

Collaborating Institutions

University College Cork

Project number: 5647

Funding source: FIRM (06RDTMFRC450)

Date: November, 2012

Project Dates: Jan 2007 – Dec 2010

How to Proceed

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UPDATE

Identification and Molecular Characterisation of Genes Influencing Irish Pork Meat Quality

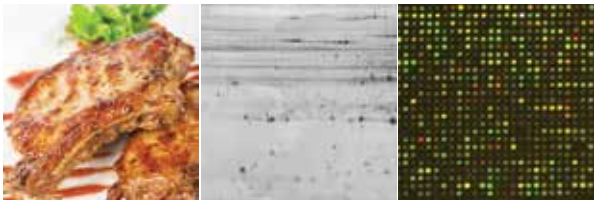
Key External Stakeholders

Pig producers, pigmeat processors, diagnostics companies.

Practical Implications for Stakeholders

Tools to provide early prediction of the ultimate quality of meat, i.e. shortly after slaughter, would help facilitate logistical decisions of pork processors in relation to meat management. However measurements that are currently applied by industry, e.g. carcass pH measured at 45 minutes postmortem, are not considered satisfactory as accurate predictors of ultimate quality.

- Molecular approaches applied in this project have led to the identification of biological markers which are associated with quality parameters. These have considerable potential as tools to predict quality in meat management systems and/or to provide a basis for the inclusion of meat quality in selection goals.
- Gene expression profiles and novel DNA markers in these gene regions were shown to be linked with meat quality in large pig populations representing Large White, Duroc and Pietrain breeds. Interestingly, several of the associations were breed-specific. Results have applications in meat management systems and breeding.
- Exudate from muscle was shown to be a readily accessible biological resource and a rich source of potential protein biomarkers of quality. More than two-hundred proteins/fragments were altered through postmortem ageing and are thus linked to quality. Twenty proteins were linked to drip loss. The findings provide a means for the future development of high-throughput protein diagnostics for diverse aspects of meat quality in an industrial setting.



Main Results

- A detailed meat quality database (tenderness, fat content, water-holding capacity etc.) for three breeds (Large White, Pietrain, Duroc) was established.
- More than 600 candidate genes were identified whose expression levels were associated with tenderness, intramuscular fat content, drip loss or PSE-like / DFD-like meat.
- Many novel associations have been identified between 190 novel markers (SNPs) discovered in the most promising candidate genes and meat quality measurements in four cohorts (total 724 animals).
- 2D proteomics resulted in the identification of protein spots significantly associated with drip loss at the one day postmortem point. These have potential to serve as early biomarkers of water-holding capacity.

Opportunity/Benefit

A panel of proteomic markers associated with a highly relevant pork quality trait for pigmeat processors, i.e. drip loss, was identified in the course of this project. The results could be further developed into rapid tests for drip loss in a commercial context. This approach could also be highly relevant for palatability traits, such as tenderness, juiciness and flavour. Expressions of interest in further developing this research are welcome.

Collaborating Institutions

National University of Ireland, Galway; University College Dublin.

Project Number: 5643

Funding Source: DAFF (06/R&D/NUIG/470)

Date: October, 2011

Project Dates: Jan 2007 – Jun 2010

How to Proceed

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UPDATE

Improved Biotraceability of Unintended Microorganisms and Their Substances in Food and Feed Chains

Key External Stakeholders

Irish Farmhouse Cheesemakers (FSAI)

Practical Implications for Stakeholders

- The data obtained contributes to a better understanding of the potential risk that *L. monocytogenes* presents to cheese producers (growth on the product, if it is contaminated) and constitutes a very useful set of data for further modelling studies in food.
- Persistent strains of *L. monocytogenes*, that are more difficult to control, were identified in some processing environments.

Main Results

- Sixteen cheesemaking facilities were sampled during the production season at monthly intervals over a one-year period. Thirteen facilities were found to have samples positive for *L. monocytogenes* on at least one occasion.
- 19% of samples at farm level were positive for *L. monocytogenes.*
- This study demonstrates the prevalence of *L. monocytogenes* in the dairy farm and processing environments and the need for good hygiene practices to prevent its entry into the food chain.
- Predictive modeling is not always applicable to food.

Opportunity/Benefit

- Contamination of food processing facilities (not food) was shown. There is an opportunity to use this pre-emptive knowledge to improve hygiene at processing facilities and prevent future issues with food contamination.
- Predictive modeling is not always applicable to food – challenge studies are necessary.
- A database of pulsed field gel electrophoresis (PFGE) profiles of *L. monocytogenes* isolates from Ireland was generated.

Collaborating Institutions

Principally the Danish Technical University, Copenhagen and the University of Veterinary Medicine, Vienna. There were 45 other participants in the project.

Project Number: 5691

Funding Source: EU FP7 Project no. 036272

Date: July 2013

Project Dates: Jan 2007-Dec 2011

How to Proceed

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UPDATE

Improved Whey Permeate Drying Using High Pressure Gas/liquid Dosing During Spray Atomisation

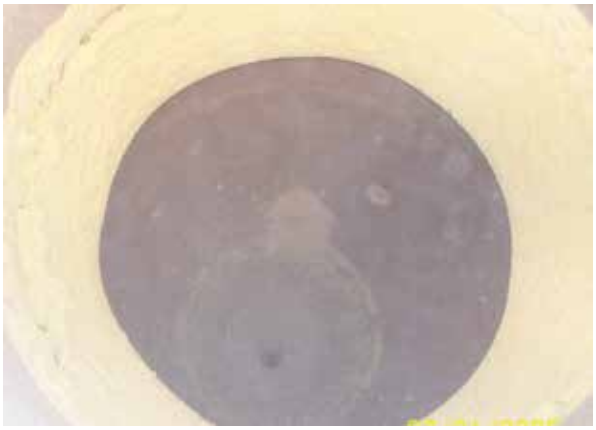
Key External Stakeholders

Irish dairy processors and whey ingredient manufacturers on behalf of their dairy farmer members.

Practical Implications for Stakeholders

The outcome/technology or information/ recommendation is:

- Modification of the feed dosage systems using high pressure gas dosing into the concentrate line to nozzle atomisers of spray driers looks promising as a means of improving permeate drying without undue deposit formation.
- Such a high pressure gas/liquid dosing is uniquely installed on Moorepark's MTL Tall-form drier and may be availed of by stakeholders and clients to pursue more detailed R&D investigations.



Deposits of whey permeate powder in the spray drier chamber.

- Complementary on-site specialised analytical services such as microscopy (National Food Imaging Centre), rheology and particle size monitoring serve enable a comprehensive development programme to be pursued.

Main Results

High pressure CO_2 dosing in the concentrate feed line to the spray atomiser would appear to potentially benefit whey permeate drying. It would appear that the beneficial effects may be attributable more to changes in powder physical properties rather than alteration of the glass transition states. It is recommended to that careful control of the gas dosing is exercised in order not to impact negatively on the wettability behavior of the powders.

Opportunity/Benefit

Processing conditions established during the course of the study may be used by dairy company R&D personnel in order to accomplish improved spray drying of whey permeates using novel technologies installed on the pilot plant drying facilities are Moorepark Technology Ltd. The results of such investigations would be readily scalable to industrial manufacturing scenarios.

Collaborating Institutions

N/A

Project number: 5986

Date: Nov, 2014

Funding source: Dairy Levy

Project dates: Sept 2009 – Dec 2012

How to Proceed

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UPDATE

Improving Retail Packaging of Beef

Key External Stakeholders

Beef processors, retailers.

Practical implications for stakeholders

A new means of vacuum skin packaging (VSP) of beef steaks which preserves a bright red colour during retail display has been developed. These packs will be as visually attractive to consumers as MAP packs without the adverse effects associated with these.

- Consumers associate a bright red colour with quality and freshness.
- High oxygen MAP packs enhance the red colour of beef steaks over an extended display period.
- Oxidation is promoted in MAP packs causing off-flavours (lipid oxidation) and less tender meat (protein oxidation)
- VSP overcomes these problems and has other advantages (longer shelf life, more compact) but the meat is dark and unappealing to many consumers.
- Exposing the beef to an atmosphere with a low concentration of carbon monoxide (CO) prior to VSP results in steaks with an attractive bright red colour.
- The pre-treatment can be tailored to give a desired colour shelf life.

Main Results

- Longer CO exposure times resulted in a deeper red layer and longer colour shelf life.
- A very long exposure time of 72 hours caused the CO to penetrate right through the steak.
- Lipid oxidation was very low in all VSP packs regardless of whether they were exposed to CO.
- Microbial counts were low and similar in treated and untreated VSP packs.
- Steaks exposed to CO prior to VSP packing were more red than control VSP steaks after 1, 2 and 3 weeks of storage.
- Short exposure times of up to 5 hours produced steaks that were attractive to a panel.
- Long exposure times of 24 and 72 hours produced steaks that the panel were suspicious of due to their over-developed appearance.

Opportunity/Benefit

This new packaging technology could be exploited by processors and retailers to provide consumers with attractive VSP steaks with all the benefits of vacuum packaging while avoiding the negative effects of VSP and MAP packaging.

Collaborating Institutions

UCC and Nofima Mat AS, The Norwegian Food Research Institute

Project Number: 5717

Funding Source: EU FOOD-CT-2006-36241

Date: October, 2013

Project Dates: March 2007 to Dec 2012

How to Proceed

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UPDATE

INFANTMET: Infant Nutrition for Programming the Gut Microbiota in Neonates

Key External Stakeholders

Food manufacturers, dairy industry, pharmaceutical companies, research communities; public health agencies and health professionals; policymakers.

Practical Implications for Stakeholders

- Establishment of the intestinal microbiota commences at birth and the microbiota has a major role in protection against pathogens, maturation of the immune system and metabolic welfare of the host.
- In terms of infant health, it is imperative to understand how early infant nutrition influences the development of a healthy gut microbiota.
- Delivery mode and gestation age have significant effects on early neonatal microbiota composition.

- A bank of infant intestinal strains (mainly *Bifidobacterium* and *Lactobacillus*) has been generated as future potential probiotics for the infant nutrition and health markets.

Main Results

- Standard Vaginally delivered Full-Term infants' microbiota remained stable at both phylum and genus levels during the first 24 week period.
- Caesarean section delivered Full-Term infants' displayed a different microbiota composition compared to Standard Vaginally delivered infants, with an increased faecal abundance of Firmicutes and decreased Actinobacteria abundance one week after birth.
- The microbiota of Caesarean section delivered infants displayed a greater flux than that seen in Standard Vaginally delivered infants over the first 24 weeks of life, and gradually progressed to a microbiota closely resembling Standard Vaginally delivered Full-Term infants over that period.
- The gut microbiota of preterm infants displayed a significantly greater abundance of Proteobacteria compared to full-term infants ($p < 0.001$) at week 1.
- The data uniquely shows the longitudinal effect of preterm birth after the infant leaves the hospital environment.

Opportunity/Benefit

The INFANTMET data provides new opportunities for optimisation of infant milk formula composition, with appropriate new bioactive ingredients such as milk fractions, probiotics and prebiotics to effectively programme the early infant gut microbiota in a manner closer to mothers milk.

Collaborating Institutions

APC Microbiome Institute
University College Cork
Cork University Maternity Hospital

Project number: 6276

Funding source: DAFM

Date: November, 2015

Project dates: Nov 2011 – Oct 2015

How to Proceed

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UPDATE

Inlet Air Humidity Control Project on TFD Spray Dryer

Key External Stakeholders

Dairy ingredient manufacturers, infant milk formula manufacturers.

Practical Implications for Stakeholders

The outcome is:

- The pilot-scale tall-form dryer (TFD) in MTL, Moorepark, is now capable of humidity control of incoming air used in drying.
- This feature provides better control over drying conditions in R&D trials, enabling experimental variation due to air variable humidity to be removed.
- It enables the influence of air humidity in the manufacture of a new product to be investigated. This assists product development in that issues with stickiness and plant blockage can be addressed at the pilot stage.

- As a demonstration project it is a model for the uptake of such technology by the dairy ingredients manufacturing sector.
- This facility is now available to the industry and to Teagasc researchers as a development tool.

Main Results

In commissioning it was demonstrated that air humidity can be controlled between a dew point of -8°C and 25°C. Product related results will come through other projects.

Opportunity/Benefit

Interested parties can gain access to the TFD in order to carry out trials under controlled air humidity conditions, i.e. humid or dry conditions can be simulated, and to develop new products and ingredients.

Collaborating Institutions

N/A

Project Number: 5982

Funding Source: Dairy Levy Fund

Date: July, 2011

Project Dates: Jul 2009–Dec 2010

How to Proceed

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UPDATE

In-situ Starch Modification in Food Formulations Using Protein

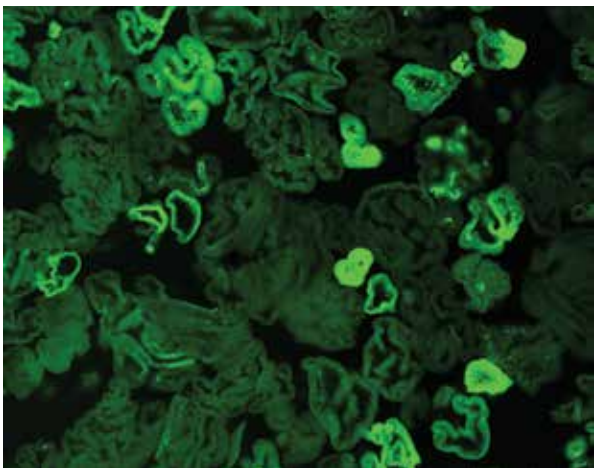
Key External Stakeholders

- Dairy ingredients and Starch Industry.
- Prepared foods and Nutritional beverage manufacturers.
- Academic and Research Institutions.

Practical Implications for Stakeholders

The objective was to study the behaviour of mixed protein-starch systems with a view to understanding protein starch interactions as a possible mechanism for in-situ alternation to starch functionality.

- Structure of the starch pastes can be altered by the presence of the proteins (intact or hydrolysed).
- Gelatinisation temperature of starch and denaturation temperature of proteins can be synergistically used to create new food structures.
- A novel rheological reactor cell can be used for simultaneous measurement of viscosity and in-vitro digestion of protein-starch mixtures.



Main Results

- The gelatinisation temperature of potato starch is lower than the temperature for whey protein denaturation / aggregation; thus in mixtures of potato starch and whey proteins, starch granules swell before denaturation / aggregation of the protein occurs, resulting in a reduction in viscosity and change in functionality.
- Hydrolysed whey protein resulted in a reduction in potato starch granule swelling during heating.
- Different blends of dairy proteins were evaluated in the presence of pre-gelatinised starch for changes in viscosity during in-vitro digestion using a newly designed rheological reactor cell. The study found that a blend of casein and α-lactalbumin may provide viscosity increase and release of peptides / amino acids for use in commercial applications, e.g., anti-reflux infant formula.

Opportunity/Benefit

New knowledge on the effect of intact and hydrolysed dairy proteins on the pasting properties of waxy maize and potato starch can be utilised for development of structure in beverage and prepared food applications. The methodologies developed in this study can be used to evaluate ingredients under simulated (in-vitro) gastrointestinal digestion for use in development of functional, medical or therapeutic beverages.

Collaborating Institutions

University College Cork, UCC

Project number: 5950

Date: Nov, 2014

Funding source: DAFM (08/RDT/MFRC/636)

Project dates: Nov 2008 – Feb 2014

How to Proceed

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UPDATE

Interaction of Gene Expression Pathways, Breed and Diet on the Nutritive and Flavour Aspects of Pigmeat

Key External Stakeholders

Pig producers and pigmeat processors.

Practical Implications for Stakeholders

The outcome of this research provides more in-depth understanding of factors such as breed, muscle, sex and diet which can have a significant effect on meat quality, in particular intramuscular fat (IMF) levels.

- A number of genetic pathways which respond to these factors through alterations in their expression levels have been identified.
- Blood parameters provide potential as novel routine markers for quality characteristics with circulating triglyceride and albumin levels associated with dietary treatments.
- Many of the genes identified as differentially expressed between Duroc and Pietrain breeds are likely to harbour genetic variability in their regulatory regions that may ultimately have applications in meat management and/or genome-assisted animal selection programmes. This project shows the potential of nutrigenomics to optimise the efficacy of pork production regimes.

Main Results

- Generation of a knowledge baseline of quality and gene expression differences between two breeds (Duroc and Pietrain) with regard to IMF deposition.
- Demonstration, at a molecular level, that the degree of IMF deposition is as a result of a suite of diverse genomic responses with the importance of signaling pathways, lipid, fatty acid and steroid metabolism and the immune response highlighted.
- A muscle effect was highlighted, in relation to IMF content, in the influence of restricted lysine treatment on meat quality, with the *semimembranosus* (leg) muscle responding more strongly than the striploin muscle. Breed also influenced the response with Duroc muscle (both muscles) exhibiting a greater response to the restricted diet.

Opportunity/Benefit

Information generated in the course of this project will aid the improvement of meat quality traits in Irish pork. The results highlight the importance of breeding and selection programmes and the need to emphasise improvement in meat quality without compromising the production gains from traditional selection for lean carcass and high growth rate. The new knowledge generated about the Duroc breed is highly relevant as there is a gradual increase in the proportion of genetics of breeds such as Duroc in Irish and European commercial operations. This project may potentially open up the application of nutrigenomics to improve the efficacy of pork production regimes. The control and manipulation of these genes is a promising pathway of research for the future and Teagasc welcomes expressions of interest in this research.

Collaborating Institutions

University College Dublin

Project Number: 5420

Funding Source: DAFF (04/R&D/TN/262)

Date: October, 2011

Project Dates: Mar 2005 – Mar 2010

How to Proceed

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UPDATE

Investigation of Bioactive Peptides in Food Through the Application of Mass Spectrometry Techniques

Key External Stakeholders

Food producers and processors, Functional/ Nutraceutical Food Manufacturers, Consumers, Pharmaceuticals, Research Communities.

Practical Implications for Stakeholders

- Bioactive peptides are segments of dietary proteins, which can have salutary health-effects.
- Analysis of bioactive peptides is however difficult due to the complex nature of food samples and requires specialised analytical instrumentation and software.
- Various sources of bioactive peptides including meat, cereals and food-by-products have been investigated using mass spectrometry techniques.
- A facility and expertise is now available to support the food industry and collaborative research in the analysis of food bioactive peptides.

Main Results

- Anti-oxidant peptides from bovine liver proteins were characterised.
- An ACE-I and renin inhibitory peptides from bovine blood proteins consisting of 2–4 amino acids in length were identified.
- Anti-inflammatory, ACE-I and renin inhibitory peptides from potato peel proteins were sequenced.

Opportunity/Benefit

Mass spectrometry based analytical methods have been developed to sequence bioactive peptides in a variety of food matrix. This facility can be utilised by the food industry to identify bioactives and support functional food product development.

Collaborating Institutions

Cork Institute of Technology
University College Cork

Project number: 5984

Funding source: Teagasc

Date: November, 2015

Project dates: Sept 2008 – Aug 2011

How to Proceed

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UPDATE

Investigation of Stickiness of Milk Powder for the Purpose of Improved Process Control in Milk Powder Manufacture

Key External Stakeholders

Dairy ingredient manufacturers, infant milk formula manufacturers.

Practical Implications for Stakeholders

- Partial substitution of lactose with proteins or maltodextrin can reduce stickiness problems during drying, crystallisation and storage.
- New measurement techniques have been developed and are applicable to industry.

Understanding the effects of specific formulation components (type of sugar, type of protein) on stickiness is of immense practical benefit with regard to new product development. To this end the project has demonstrated the role of different powder constituents (proteins, maltodextrins and lactose) on stickiness and has developed measurement techniques that are in use in our laboratories.

Modelling was used to show how to deal with the constraints of drying sticky products (including infant formula and other high lactose formulations) and how to optimise process control to maximise production while avoiding plant blockage (and downtime) while air humidity varies.

Main Results

- Partial substitution of lactose with proteins (i.e. higher molecular weight components) is a means of reducing stickiness problems.
- Maltodextrin inclusion in skim milk powder decreases susceptibility to sticking during drying and crystallisation during subsequent storage.
- Modelling was used to show how to deal with the constraints of drying sticky products (including infant formula and other high lactose formulations).

Opportunity/Benefit

Teagasc can assist interested parties in improving process efficiencies in the manufacture of dried products. The opportunity exists for further research in this area and expressions of interest from relevant companies are invited.

Collaborating Institutions

University College Cork

Project Number: 5632

Funding Source: DAFF (06/RD/TMFRC/443)

Date: July, 2011

Project Dates: Nov 2006–Nov 2010

How to Proceed

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UPDATE

Investigation of the Presence of Anti-Nutritional and Toxic Compounds in "Health Foods"

Key External Stakeholders

Manufacturers, wholesalers and retailers of health food products, general public, regulatory agencies: DAFF, FSAI, IMB.

Practical Implications for Stakeholders

The objective of this project was to investigate the occurrence of microcystin (MC) and aristolochic acid (AA) toxins in algal and herbal products, respectively.

- Methods were developed and validated to detect AA and MC toxins, which can be employed to monitor the safety of health foods.
- Contaminated products were detected and removed from the Irish market.
- A number of health alerts were published worldwide including, Ireland, the UK and Canada.

Main Results

- MC toxins were detected in Klamath Lake blue green algae (BGA) products, which are sold in health foods shops throughout the island at concentrations between <0.5 and 3 mg/kg.
- MC toxins were not detected in spirulina BGA products, which may be used as a substitute for Klamath Lake products.
- AA toxins were detected in some herbal preparations sold on the island but these products have been removed from the market.

Opportunity/Benefit

- Stakeholders can now access analytical methods for detecting AA and MC toxins.
- A novel biosensor assay was developed for detecting MC toxins, which has the potential to be exploited as a rapid test.

Collaborating Institutions

Xenosense Ltd., Belfast.

Project Number: 5429

Funding Source: DAFF (Safefood 04CR-06)

Date: January, 2010

Project Dates: Oct 2005 – Oct 2008

How to Proceed

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UPDATE

Irish Phytochemical Food Network: Impact of Agronomy and Varietal Selection on the Phytochemical Content of Vegetables

Key External Stakeholders

Vegetable growers, food manufacturers, research communities, public health agencies and health professionals, policymakers.

Practical Implications for Stakeholders

- It is possible to select varieties which naturally accumulate higher quantities of specific, health-giving phytochemicals.
- Agronomic practice does not seem to influence the accumulation of chemical groups such as Total Phenolics and Total Flavonoids, but can influence the quantity of specific phytochemicals, such as Glucobrassicin and neo-Glucobrassicin in organically grown Brassica crops.
- Onion crops readily assimilate selenium applied as a fertiliser.
- Red and White sprouting Broccolis contain, on average, 2–3 times the levels of dietary important glucosinolates than traditional green broccoli varieties.

Irish Phytochemical Food Network

Main Results

- Vegetable tissue, commonly treated as waste such as Broccoli stalks and carrot leaves are important sources of bioactive compounds, such as glucosinolates and polyactylenes.
- Coloured varieties of alliums and broccolis do contain, on average, higher levels of total phenolics and total flavonoids. However white and yellow coloured carrots contain less polyactylenes than orange coloured carrots.
- The overall levels of phytochemicals in vegetable crops are extremely reactive to changes in climate.
- Organically grown crops, initially, have higher levels of total phenolics and total flavonoids, however this difference equalizes as crop yields equalize.
- Organic management of vegetable crops led to higher levels of soil bacteria, fungi and free living nematodes.
- Minimal processing of carrots, such as the shape into which they are cut, has a significant impact on the retention of polyactylenes.
- Heat treatment of brassicas can lead to a loss of glucosinolate compounds in the vegetable.
- Storage of processed carrot in modified atmosphere packaging maintained their polyacetylene content or improved it over a 15 day period.

Opportunity/Benefit

The IPFN data provides new information for the increase and/or retention of naturally occurring, health promoting compounds in vegetables, such as glucosinolates, polyactylenes and flavonoids by optimising variety and minimal processing technologies.

Collaborating Institutions

University College Dublin

Project Number: 5864

Funding Source: DAFM

Date: November, 2015

Project Dates: Aug 2008 – Oct 2015

How to Proceed

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UPDATE

Irish Seaweed Polysaccharides for Gut Health

Key External Stakeholders

Consumers, society, government authorities/ legislators and the food industries.

Practical Implications for Stakeholders

Seaweed is a natural source of bioactive components such as polyphenols, vitamins, antioxidants, polysaccharides and dietary fibres. This project is aimed at understanding the role of seaweed derived polysaccharides in gut health and targeting prebiotic potential of Irish seaweeds for development of functional food products.

Main Results

- Four Irish seaweeds viz. *Laminaria*, *Fucus*, *Ulva* and *Palmaria* were collected from the west coast of Ireland and were used for extraction and separation of polysaccharides.
- A hot HCl extraction method was used for the extraction of polysaccharides. Following neutralisation the extracts were electrodialyzed for desalination and polysaccharides were precipitated using ethanol. The extracts were then freeze dried.
- In vitro digestion using digestive enzymes was undertaken and the digests were used for testing through faecal fermenters.
- Diafiltration was used to separate the polysaccharides and oligosaccharides depending on their molecular weight cut offs.

Opportunity/Benefit

Considering the nutritional profile of Irish seaweeds and functional food product development is the target of this project. Cost effective methods for extraction and purification of the polysaccharides and desalination are being developed. These methods will help to develop cost effective products for the food industry. Prebiotic potential studies through clinical trials would support health claims pertaining to gut health for these products.

Collaborating Institutions

Teagasc Food Research Centre, Moorepark

National University of Ireland, Galway

Teagasc Food Research Centre, Ashtown

Project number: MDBY 6588

Date: May, 2015

Funding source: DAFM

Project Dates: July 2014 – Nov 2017

How to Proceed

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UPDATE

Kinetic Trapping: A Novel, Energy-Efficient Approach to Designing Protein-Based Fat Replacers

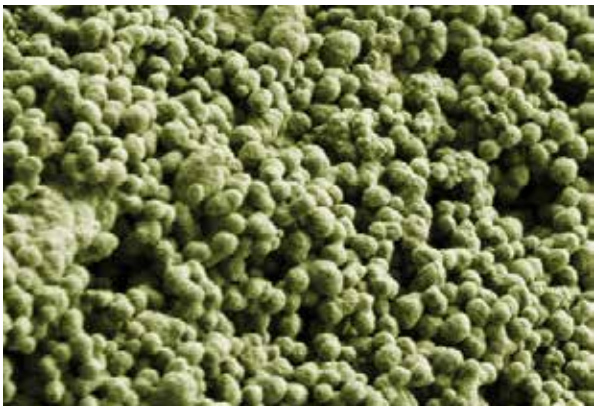
Key External Stakeholders

Dairy & food industry, ingredient manufacturers.

Practical Implications for Stakeholders

Kinetic trapping is a novel low-energy process for producing nano- and micro-sized protein particles. The technology relies on precise process control of standard food ingredient mixtures using readily available food manufacturing equipment. The kinetic trapping process represents a **new platform technology** for producing size-controlled protein particles in the nano- and micro-size range which was developed and used in this project to produce novel fat replacer ingredients. The benefits of such ingredients when compared to other fat replacers include reduction in capital costs, lower energy demand, enhanced nutrition & functionality and improved sensory quality. Also the use of non-chemically modified i.e. natural ingredients is significant.

Because of health concerns relating to Olestra, a chemically modified oil-based fat replacer, the demand



for protein and polysaccharide based fat replacers is increasing. With the market for fat-replacers globally expected to be **280,100 metric tons** with a compound annual growth rate of 6.03% between 2011 and 2015 (Global Industry Analysts), the availability of such a novel fat replacer ingredient has significant implications for the dairy and food industry and specifically ingredient manufacturers.

Main Results

- A new whey protein-based fat replacer ingredient was produced using kinetic trapping.
- The novel fat replacer ingredient was produced in dried form with and without konjac gum (soluble dietary fibre) and had creamy texture when added to ice cream. It was whey protein particles size-optimised (100 nm – 10 mm) and calcium enriched (~100mM Ca+).
- Conditions for production were optimised and ingredients produced in spray dried form.

Opportunity/Benefit

This novel platform technology represents a significant advancement in production of fat replacer ingredients and a patent application is currently being filed to protect the novel process and resulting unique products. Teagasc is keen to engage with dairy and food industry and ingredient manufacturers to consider collaborative opportunities as a means of optimising, validating and ultimately commercialising this technology.

Project number: 6041

Funding source: EI (POC-2009–260)

Date: January, 2012

Project Dates: Jan 2009 – Dec 2010

How to Proceed

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UPDATE

Meat4Vitality: Enhancement of Texture, Flavour and Nutritional Value of Meat Products for Older People

Key External Stakeholders

Meat processors; Ingredients companies; Regulatory agencies: charities; nutritionists; care homes; DAFM.

Practical Implications for Stakeholders

Meat intake of elderly people is often reduced since meat is a complex matrix that can present a challenging substrate from a texture perspective. Older people pay closer attention to the texture of the food and are more demanding in this regard. There is considerable evidence that texture modified meat products will be more acceptable to older adults and lead to improvement in intakes. Meat products are ideal vehicles for fortification with extra protein, vitamins and minerals and reformed products will provide enhanced and targeted nutrition to promote healthy ageing and vitality in the older population.

Main Results

- Beef patties were enriched with plant-based protein ingredients: pea protein isolate, rice protein and lentil flour at two inclusion levels (3% and 7%) and their technological characteristics assessed.
- Preliminary results indicated that rice protein demonstrates good potential to enhance protein intakes as part of healthy beef products for the elderly.
- Currently, texture enhanced beef steaks are being developed.

Opportunity/Benefit

Healthy aging is a grand challenge of growing international importance. Red meat is intrinsically a source of certain nutrients which are particularly important for healthy aging. These include: protein for growth and repair, omega-3 fatty acids for cognitive function, as well as vitamins and micronutrients (iron, calcium, selenium and zinc).

Within the project we will optimize the meat processing formulation and packaging technologies in relation to food structure, flavour and nutritional value. We will demonstrate that meat products can be made more appealing to older adults by modifying their texture, while retaining or enhancing their nutritive value.

Eating healthy and getting active means you are less likely to develop a chronic disease at any age, “it’s never too late”.

Collaborating Institutions

University College Cork

Project Number: 11/F/045

Funding Source: FIRM

Date: 03/06/2015

Project Dates: 01/04/2013-31/07/2016

How to Proceed

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UPDATE

Mining for Milk Based Bio-Actives Using Microbial Fermentations

Key External Stakeholders

Irish dairy industry, dairy farmers, consumers.

Practical Implications for Stakeholders

- Added functionality of casein, whey and milk based powders with health benefits beyond those associated with nutrition, increased profitability to the Irish milk sector.
- Improved health benefits to the consumer.

Main Results

The key results were:

- Dairy associated microbes with extracellular proteolytic activity were identified.
- Fermented casein, whey and skim milk based substrates and water soluble extracts from commercial cheeses, were made into freeze-dried powders, a number of which had bioactivity across a range of health indicator assays.
- Optimized fermentation and post-fermentation heat treatments were established that retained bioactivity.

Opportunity/Benefit

The range of bioactivities associated with the microbial fermented milk products will increase the functionality of milk-based ingredients, adding market value and extending the applications for the dairy industry. The development of products containing the bioactive ingredients will directly benefit public health. This project was a component of FHI, the primary objective of which was to attempt to release peptides from milk proteins that demonstrate bioactivity in the areas of interest to FHI.

Collaborating Institutions

DCU, UCD, UCC, UL and the companies Carbery, Dairygold, Glanbia and Kerry

Project number: 5939

Date: November, 2014

Funding source: EI & Industry; CC20080001

Project dates: Jan 2009 – Jun 2013

How to Proceed

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UPDATE

National Food Residue Database (NFRD)

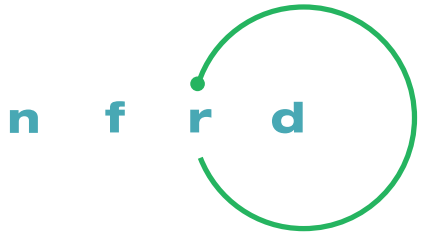
Key External Stakeholders

Food industry, state agencies (DAFF, Pesticide Control Service, FSAI, RPII, EPA, Marine Institute, State Laboratory), scientific community, general public.

Practical Implications for Stakeholders

This funding has ensured the continued development and enhancement of the National Food Residue Database (NFRD), leading it to becoming the 'one stop shop' for chemical residue information in food in Ireland.

The project resulted in 49 new datasets being published on the NFRD website, along with two NFRD annual reports. An exposure assessment to pesticide contamination in food showed that the exposure to pesticides was well below the allowable daily intake (ADI) and the risk to the consumer from pesticides was low.



Consumer and industry confidence in food production and processing is key to the sustainability of the food industry in this country. The information contained on the NFRD can be used to promote the safety and quality of Irish food, through its use by the food industry and policy/regulatory agencies. In addition, 'country of origin' for pesticide results can aid importers of fruit and vegetable products to identify countries with safer produce. The NFRD needs to be continuously developed and maintained to help ensure that food safety is at the heart of the development of the food industry in Ireland.

Main Results

- 49 new datasets were uploaded and published on the NFRD website over the duration of the project.
- Two issues of the NFRD Report (2007/2008 and 2009) were published.
- Exposure analyses were conducted for 10 of the most commonly found pesticides (captan, carbendazim, chlorpyrifos, diphenylamine, fenahexamid, imazalil, iprodione, malathion, prochloraz and thiabendazole).
- Results from this study showed that exposure to pesticides was well below the ADI and the risk to the consumer (both adult and child) from pesticides was low.
- Extensive dissemination was been carried out during the project through publication on the NFRD website, NRFD annual reports and through a workshop.

Opportunity/Benefit

The National Food Residue Database can be used as a reference tool by exporters, when queried about the safety of Irish food. It can also be used by importers and processors when buying products from outside of Ireland.

Collaborating Institutions

University College Dublin

Project Number: 5640

Funding Source: DAFF (06RDTAFRC535)

Date: January, 2012

Project Dates: Nov 2006 – Nov 2009

How to Proceed

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UPDATE

Natural Ingredient Cheese Solutions

Key External Stakeholders

Dairy Industry, Food Manufacturers.

Practical Implications for Stakeholders

Methods to augment, accelerate and diversify cheese flavour.

- A method to attenuate lactic acid bacteria for use as adjuncts to augment cheese flavour.
- Rapid methods to screen lactic acid bacteria for flavour potential.
- Database of key volatile cheese flavour compounds.
- Protocols for production of cheese concentrates, using attenuated lactic acid bacteria.
- Development of a yeast based encapsulation system to augment cheese flavour development.
- Use of camel chymosin to alter texture in low moisture part-skim Mozzarella.
- Protocols for accelerating and diversify cheese flavour in Ingredient cheese applications.

The study has highlighted a number of approaches to control, augment, accelerate and diversify cheese flavour in a range of different applications.

Main Results

- Microfluidization is a useful technique to attenuate lactic bacteria and yeast to enhance their flavour development capability.
- Attenuated yeast can be used to entrap enzymes critical for cheese flavour development and to control their subsequent release into the cheese matrix during ripening to accelerate flavour development.
- Production of fast-ripened cheeses with diverse flavours for use in ingredient applications.
- Model system to rapidly screen lactic acid bacteria, enzymes and yeasts for cheese flavour development.

Opportunity/Benefit

Researchers involved in this project have the experience and expertise to aid producers to alter existing cheese products or develop new cheese flavour concepts using natural lactic acid bacteria, yeasts, enzymes. Extensive knowledge and expertise exists in the flavour chemistry facility at Teagasc Food Research Centre Moorepark in the extraction, concentration and identification of cheese flavour volatiles. Consultancy and contract research opportunities are available to both national and international clients in the area of cheese flavour development.

Collaborating Institutions

University of Limerick, University College Cork

Project number: 5938

Date: November, 2014

Funding source: DAFF 08/TMFRC/670

Project dates: Dec 2008 – July 2013

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UPDATE

New and Rapid Methods for Evaluating the Baking Characteristics of Irish Grown Wheat Varieties

Key External Stakeholders

Millers, bakeries, food ingredients companies, food manufacturers.

Practical Implications for Stakeholders

Based on the results of this project, it is now possible for Teagasc to recommend rapid, scientific, accurate tests on grains, flours, doughs and baked products to the industry. Furthermore, researchers at Ashtown have the expertise to work with industry and increase capabilities in these areas, or to engage in confidential industry-led research, using these newly developed methodologies.

As some traditional methods are not deeply scientific, it is possible that some vital information relating to dough and baked properties had not previously been uncovered. Therefore, the methods which have been developed should be of significant advantage to the milling, baking and food industry for a complete analysis and better characterisation of their raw materials and end products, while complementing the more traditional cereal methods.

The new suite of modern and novel methods developed for use along the complete chain from the grain to the finished products includes spectroscopy, rapid flour protein fractionation, laser imaging and digital image analysis.

Main Results

Novel methods have been developed in the following areas:

- Near infra-red spectroscopy of grain, flour, dough and bread.
- Flour protein fractionation.
- Native starch and protein properties of flours.
- Imaging of confectionary batter and cookie dough during baking.
- Laser imaging of bread dough fermentation and density properties.
- Digital image analysis of bread crumbs.

Opportunity/Benefit

Advice, consultancy work and/or technical services, relating to the novel and/or traditional methods, in the areas of wheat chemistry, dough rheology and baking processes, can be provided through the Teagasc Food Research Centre, Ashtown.

Collaborating Institutions

University College Dublin

Project Number: 5412

Funding Source: DAFF (04/R&D/TN/249)

Date: June, 2011

Project Dates: Jul 2005 – Jan 2009

How to Proceed

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UPDATE

Novel Fruit Products from Apples and Other Tree Fruit (IsaFruit)

Key External Stakeholders

Vegetable processors, government authorities/ legislators, consumers, food research scientists.

Practical Implications for Stakeholders

The project developed a number of fresh cut fruit salads and ready-to-eat dessert products enriched with functional ingredients to capitalise on the growing functional food market. These products incorporated a range of functional ingredients including pre- and pro-biotics. An Irish based SME was involved in the development of these products and is interested in launching them when economic conditions improve.

Main Results

- Fruit cultivars with optimal properties for the development of fruit based desserts and fresh cut salads were selected based on their sensory, physicochemical and quality attributes.
- Novel protocols were developed for incorporation of functional ingredients using technologies such as edible films and vacuum impregnation.
- Functional ingredients were added at levels required to deliver the health benefit based on manufacturers' recommendations.
- At all points the sensory and quality attributes of the products were assessed to ensure that a real marketable product was being produced.

Opportunity/Benefit

Fruits and fruit products are seen as healthy by consumers. However, if their market share is to grow they need to take advantage of the growing functional food market which fulfils consumer demands for products which deliver a health benefit beyond basic nutrition. This project demonstrated that fruit based functional foods with optimal functional, quality and sensory properties could be developed.

Collaborating Institutions

University College Dublin, Nature's Best Ltd, IRTA

Project number: 5548

Funding source: EU FP6 (016279)

Date: July, 2011

Project Dates: Jan 2006 – Sep 2010

How to Proceed

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UPDATE

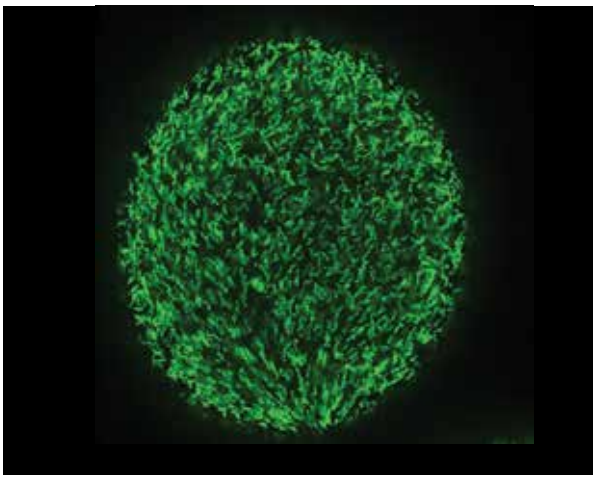
Novel Gel-Encapsulation Technology

Key External Stakeholders

Food/Medical food, pharmaceutical and animal feed companies, biotechnology start-up companies.

Practical Implications for Stakeholders

- A novel gel-encapsulation technology was developed, using dairy based micro beads which would be of interest to companies wishing to incorporate sensitive components, including probiotics, into their products.
- Encapsulation matrices are suitable for incorporation into liquid of high moisture food/feed.



Main Results

- A novel gel-encapsulation technology was developed and validated for the protection of probiotic bacteria but would also be suitable for other sensitive ingredients such as peptides or phytochemical compounds.
- Gel-encapsulation ensured high probiotic viability during extended storage in fruit-based products, such as cranberry juice.
- *In vivo* gastro-intestinal transit demonstrated delivery of high numbers of live probiotic bacteria to the lower intestine.

Opportunity/Benefit

A patent application has been filed by Teagasc covering process conditions for generating gel microbeads and application of the encapsulation method. This provides food and related companies with the opportunity to benefit from improved cost efficiency and product shelf-life through use of this robust encapsulation process. Teagasc is seeking partners for commercialisation of the technology with a view to licensing in a number of fields of use.

Collaborating Institutions

University College Cork

Project Number: 5457

Funding Source: Dairy Levy Fund

Date: February, 2010

Project Dates: Jul 2005–Dec 2009

How to Proceed

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UPDATE

Novel Proteins and Peptides from Seaweeds

Key External Stakeholders

Protein ingredient manufacturers, marine processors.

Practical Implications for Stakeholders

- Novel protein sources for use in the sports nutrition markets, Halal and Kosher as well as vegetarian markets.
- Increases essential amino acid profile of products.
- Imparts a health benefit.

Main Results

- Bioactive peptides isolated from red seaweed were found to reduce blood pressure when tested in the lab and in spontaneously hypertensive rats (animal models)
- A novel hydrolysis and purification methodology was employed and applied to red seaweed.
- Optimal conditions for developing bread products with this hydrolysate were determined and blood pressure regulation activity was maintained.

Opportunity/Benefit

Protein extracts developed as part of this project were examined for their essential amino acid content, ability to inhibit enzymes important in blood pressure control and suitability for use in cereal products such as bread. Extracts could have benefits in the manufacture of food products for the prevention of heart health associated problems such as blood pressure.

Collaborating Institutions

National University of Ireland, Galway

University College London, UK

Project number: NutraMara – The Marine Functional Foods Research Initiative, Teagasc Walsh Fellowship Programme and INFOGEST (EU COST Action FA1005)

Date: May 2015

Funding source: DAFM and Marine Institute and Teagasc

Project Dates: October 2009 – October 2014

How to Proceed

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UPDATE

Novel Strategies for Optimization of Cheddar Cheese Manufacturing Process

Key External Stakeholders

Dairy Industry.

Practical Implications for Stakeholders

Consistency in terms of quality and yield are vital in ensuring an economic return from the commercial production of Cheddar cheese. Seasonal variation in the lactose content of Irish milk and residual galactose accumulation in cheese arising for introduction of new starter systems have the potential to impact on Cheddar cheese quality.

- Starter culture systems were developed that can greatly reduce residual lactose levels in ripening cheese and curd washing during manufacture was demonstrated as a means of controlling lactose levels in cheese and thus improving consistency in manufacture of quality cheese.

Main Results

Starter systems containing galactose metabolizing *St. thermophilus* and *Lb. paracasei* strains have the potential to remove residual galactose from ripening cheese and reduce some of the quality issues associated with galactose in cheese including off flavors, inconsistency in composition and browning on cooking.

Curd washing during manufacture was demonstrated as a means of reducing unfermented lactose in, and altering the sensory properties of, Cheddar cheese.

Opportunity/Benefit

Starter systems investigated as part of this project demonstrated that levels of residual galactose that accumulate in cheese manufactured using *St. thermophilus* containing starter systems can be controlled.

The data generated clearly indicate how curd washing regimes may be applied for cheesemaking under different conditions (milk protein levels, pH at set and at whey drainage, different calcium levels) to control the level of lactose and lactic acid in the cheese from a quality perspective, and to differentiate sensory properties.

Collaborating Institutions

UCC, UL

Project number: 5952

Date: November, 2014

Funding source: DAFM 08/RD/C/604

Project dates: Nov 2012 – Sep 2013

How to Proceed

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UPDATE

NOVTECH: The Use of Novel Technologies for Improving Quality and Process Efficiency in High Protein Beverage Production

Key External Stakeholders

Food manufacturers, dairy industry, research communities.

Practical Implications for Stakeholders

- The novel technology of supersonic steam injection provides an alternative method for thermal processing of dairy products.
- An investigation into the benefits with regards to the physical and chemical properties of dairy based products processed using this technology.

Main Results

- Steam injection is a direct method of thermal processing in which food grade steam, under pressure, is directly mixed with the food product creating a more rapid rate of heat transfer than traditional methods.
- Maklad injectors use a specialized form of de Laval nozzle to achieve supersonic flow within the injection chamber. This is to aid in the rapid mixing of product and steam streams and provides a small level of homogenization.
- The rapid heat transfer and subsequent flash cooling result in a reduced thermal load experienced by the product. This has been shown to impart reduced protein denaturation in skim milk compared to products processed using conventional indirect tubular heat exchangers.
- The use of flash cooling within the system provides an opportunity for a small level of total solids concentration. This can be controlled by altering the temperature differential between the product inlet and flash cooling outlet.
- The steam injection unit can be used to 160oC and is Teflon coated to reduce burn on from product when mixed with the steam.

Opportunity/Benefit

this technology in conjunction with dairy based products, particularly dairy based protein beverages. This heat treatment technology has the potential to yield dairy products with improved physical and chemical characteristics compared to that of conventional indirect heat treatments.

Collaborating Institutions

University College Cork

Project Number: 6284

Funding Source: DAFM

Date: November, 2015

Project Dates: Oct 2012 – Oct 2016

How to Proceed

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UPDATE

Nutraceutical and Functional Food Bio-active Peptides in Beef, Bovine Offals and Fermented Meat Products

Key External Stakeholders

Beef processing sector.

Practical Implications for Stakeholders

The main outcome of this research provides support for a strategic approach to recovering value from the meat processing chain. Clear evidence has been presented that bio-active peptides can be generated from low value meat and offal. The capabilities for generating, isolating and characterising bio-active peptides from meat sources have been established at Teagasc. The assays have been optimised and are now part of a full peptide isolation, purification and characterisation infrastructure available to the Irish food industry. The potential of generating bio-active peptides from bovine offal and low value muscle has been demonstrated in this project. Research in the extraction of commercially valuable peptides from

meat and meat industry by-products is in its infancy and this project provides a solid foundation on which future development and discovery will inevitably yield scientific advancement and commercial return.

Main Results

- Capabilities established for the generation, isolation and characterisation of bio-active peptides from meat sources.
- Antioxidant peptides successfully generated from bovine liver.
- Peptides with antioxidant and antihypertensive activity isolated from brisket fractions.
- Peptides generated from bovine lung which exhibited antioxidant, antihypertensive and antithrombotic activity.
- Heart peptide fractions displayed antioxidant and antimicrobial activity.
- Bio-active peptides generated from proteins isolated from bovine muscle.

Opportunity/Benefit

Knowledge generated in this research will be beneficial in developing strategies to recover value from meat processing streams. Such scientific expertise and infrastructure should act as a springboard to encourage the exploitation of the protein component of offal and waste streams produced by the meat industry, as a source of high value biologically active ingredients with food and pharmaceutical applications.

Collaborating Institutions

University College Cork

Project number: 5636

Funding source: DAFF (06RDTAFRC472)

Date: March, 2012

Project Dates: Dec 2006 – Nov 2010

How to Proceed

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UPDATE

Pathogenic *Escherichia coli* Network

Key External Stakeholders

Farmers, food processors, scientists, regulatory personnel, medical doctors, veterinarians, epidemiologists, microbiologists, consumers, European Food Safety Authority (EFSA).

Practical Implications for Stakeholders

Up-to-date information and advice on the different *Escherichia coli* pathogens, detection, epidemiology, pathogenicity, virulence, ecology and control in the farming and beef processing stages of the food chain.

Main Results

Six reports were published on current knowledge, identifying data gaps and making a range of key recommendations designed to improve food/medical testing, epidemiological investigations, control and our overall understanding of these serious pathogens.

Opportunity/Benefit

This project furthered the existing knowledge base by bringing together international experts on pathogenic *E. coli*, especially verocytotoxigenic *E. coli* (VTEC), to discuss and resolve issues relating to culture and molecular detection, virulence, pathogenicity, epidemiology, ecology and control.

Collaborating Institutions

See full Technology Update

Project Number: 5704

Funding Source: FP6 (FOOD-CT-2006-036256)

Date: June, 2011

Project Dates: Jan 2007 – Jan 2010

How to Proceed

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UPDATE

Phage-Insensitive Cultures for the Production of Fermented and Probiotic Foods

Key External Stakeholders

Commercial culture suppliers, fermented dairy food producers, wider dairy industry, lactic acid bacteria and phage research communities.

Practical Implications for Stakeholders

Bacteriophages are the primary cause of fermentation failure in the fermented dairy foods industry. Lysis of the starter culture can delay or even halt the milk fermentation process leading to low quality products, or even discarding of the milk. The destructive potential of these agents is exaggerated in modern processes which employ cultures on a more or less continuous basis and where huge numbers of starter cells are required to process large volumes of milk to cheese. The economic impact of such attacks can be significant, particularly in a commodity product such as cheese where profit margins are very tight.

The main outcomes generated from this project are:

- Food-grade strategies have been developed to improve commercial starter cultures with respect to bacteriophage resistance.

- Improved cultures have been transferred to industry where they have replaced bacteriophage-sensitive strains, thus improving the efficiency, reliability and longevity of starter cultures.

Main Results

- The molecular mechanisms underpinning phage-host interactions were characterised. The host response is strongly targeted to the cell wall, suggesting that the phage presence is sensed as an extracytoplasmic stress, affecting membrane integrity.
- Phages infecting commercial probiotic cultures were isolated and characterised.
- Classical food-grade approaches and novel mobilisable plasmids were used to improve the phage-resistance phenotype of commercial starters, some of which have been transferred to industry.

Opportunity/Benefit

There is an ongoing opportunity for other starter culture and dairy companies to benefit from the capabilities developed within this project through sponsored research or service provision. Expressions of interest from relevant companies are welcome.

Collaborating Institutions

University College Cork.

Project Number: 5458

Funding Source: Dairy Levy

Date: October, 2011

Project Dates: Jun 2005 – Dec 2010

How to Proceed

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UPDATE

Pork Food Safety

Key External Stakeholders

Irish pork producers, Irish pork processors, regulatory agencies (FSAI & DAFM), retailers.

Practical Implications for Stakeholders

- Pig farm: Urea or ammonia may be used to disinfect *Salmonella* and/or *Yersinia enterocolitica* contaminated pig slurry.
- Pig abattoir: A time-temperature combination of 2.67 min at 60°C is required to achieve a 1 log reduction in *Y. enterocolitica* in scald tank water. The predicted equivalent at 65°C is 0.59 min.
- Pig abattoir: Cross contamination occurred in the lairage and during carcass processing. More effective sanitation is recommended.

Main Results

The incidence and spread of *Salmonella* and *Y. enterocolitica* on Irish pig farms could be reduced through the application of urea or ammonia to disinfect animal waste. *Y. enterocolitica* contamination on pork carcasses would be reduced if the time-temperature combination in the scald tank was set at a minimum of 2.67 min at 60°C or equivalent and cross contamination of carcasses could be prevented if the lairage area was disinfected more efficiently. All of this would result in reduced pathogen contamination on pork carcasses and in pig products thus protecting public health and pork consumers.

Opportunity/Benefit

This project provided information on the control of key pathogens in Irish pork at the farm and processor stages. Interested industry and regulatory personnel should contact Dr. Declan Bolton directly to discuss implementation. The main benefit of implementing the results of the project would be a reduced risk of pork associated illness thus protecting public health and the reputation of the Irish food industry. Furthermore, the current status of the Irish pig industry in European Food Safety Authority (EFSA) league tables would improve.

Collaborating Institutions

University College Dublin

Project Number: 5706

Funding Source: FP6 (FOOD-CT-2007-036245)

Date: March, 2012

Project Dates: Jan 2007 – Dec 2011

How to Proceed

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UPDATE

Potato Peels: a Rich Source of Pharmaceuticals and Bioactives

Key External Stakeholders

Potato growers, potato processors, pharmaceuticals, functional food manufacturers, government authorities/legislators, consumers, food research scientists.

Practical Implications for Stakeholders

Large volumes of potato peels as by-products are generated as a result of processing of foods. This project highlighted the potential use of this waste as a source of bio-active compounds for bio-pharmaceutical and natural bio-control agents.

Main Results

- A set of optimised methods for the extraction, isolation, purification and characterisation of glycoalkaloids was developed.
- The purified aglycone glycoalkaloid, solanidine, had a high potential to synthesize novel anticancer and apoptotic drugs.
- None of the 9 different cultivars exceeded the threshold of toxicity of glycoalkaloids content of 1 mg/g. As expected, room temperature storage influenced the greater production of glycoalkaloids in peels when compared to potatoes stored at chilled temperature.
- Glycoalkaloids and potato peel extracts enriched in glycoalkaloids did not possess anticancer potential nor did they induce apoptosis nor showed cardioprotective effects. However, they demonstrated anti-inflammatory and immuno-modulatory potentials. Whilst the potato peel peptides showed anti-inflammatory, anti-hypertensive and modest anti-oxidant activities.
- Pelleted potato peels rich in glycoalkaloids controlled the level of nematode *Globodera pallida* in conjunction with crop rotation or nematicide and more importantly the light treated pelleted peels had significantly higher 'suicide hatch' rate of potato nematodes.

Opportunity/Benefit

The methods developed for the recovery of compounds from their waste streams will allow potato processors to exploit a potentially valuable resource. Information on the levels of toxic glycoalkaloids in Irish fresh potato cultivars and the effect of commercial storage conditions used by the processing industries will be available. The outcomes of the project will also indirectly address the call for sustainable agriculture development as it seeks to find an environmentally safe solution for the control of potato nematodes, a major pest of potato crops, which cause significant damage and losses.

Collaborating Institutions

University College Cork; Largo Foods, Ashbourne, Co. Meath; Wilson's Country, Craigavon, Co. Armagh.

Project number: 5961

Date: December, 2008

Funding source: DAFF 08/RD/TAFRC/673

Project dates: Dec. 2008 – July 2014

How to Proceed

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UPDATE

Pre-commercial Scale-up of Biologically Active Milk Protein Hydrolysates (FHI Project WP3)

Key External Stakeholders

This Industry-led, EI-funded Food for Health Ireland (FHI) project was co-funded by 4 major Irish dairy manufacturers Glanbia, Kerry, Carbery and Dairygold. The FHI project was governed by a consortium agreement drawn-up in conjunction with all participants which set out protocols for the uptake of results.

Practical Implications for Stakeholders

Successful precommercial scale-up work at Moorepark retained bioactivity of FHI lead functional compounds (LFCs) i.e. enzymatically-produced milk protein hydrolysates and their sub-fractions in line with their original laboratory-based protocols, and also satisfied the microbiological specification necessary for formulation of the active ingredients in human clinical trial diets (undertaken by UCD).

- Pre-commercial scale-up contributed substantively towards the compilation of technological data which will be incorporated in scientific dossiers setting out health claims for individual LFCs to be submitted to the European Food Safety Authority (EFSA).
- In addition to the protocols and LFC's assigned by FHI, the pre-commercial scale-up team generated a novel casein-based hydrolysate and sub-fractions which was biologically active against multiple physiological functions (anti-inflammatory; endothelial and satiety-ghrelin)
- Technological developments employed to enrich biological activity during scale-up included advances in membrane separation technology e.g. charged- and electro-membrane based processes.

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Main Results

The following is a list of outputs accomplished by the FHI pre-commercial scale-up team:

- No. protocols validated (laboratory): 150
- No. plant scale-up trials: 50 (small) and 35 (large)
- **LFC's** (Lead Functional Compounds): 6 based on the MF025 hydrolysate series.
- **ACR** (Available Centre Result): 1 (Hypoallergenic Infant Dessert)
- **NPD** (Novel Product Development): 3 (Family Milk & HA Infant Dessert)
- Complementary research highlighted the benefits of protein aggregation-enhanced enzymatic hydrolysis.

Opportunity/Benefit

Ground rules laid down in the FHI consortium agreement set out conditions for priority right of access by its Industry Partners to project outputs with commercial potential. Otherwise, expressions of interest in the scale-up and characterisation of FHI milk protein hydrolysates and their fractions will be entertained by the technology transfer officer. An FHI 'available centre result' (ACR) based on the novel formulation of a hypoallergenic infant food (desert-format) is currently licensed out for evaluation.

Collaborating Institutions

UL, UCD, UCC, DCU

Project number: 5940

Date: October, 2014

Funding source: Enterprise Ireland

Project dates: June 2008 – May 2013

How to Proceed

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UPDATE

Predicting Beef Eating Quality

Key External Stakeholders

Beef processors, retailers.

Practical Implications for Stakeholders

Beef processors could use the Meat Standards Australia (MSA) grading system to sort individual cuts into eating quality classes priced accordingly. Such a guarantee of expected eating quality could increase the share of the market particularly at the premium end. For optimum eating quality boning should not be carried out on the day after slaughter. Processors and retailers need to consider the negative effects of MAP on eating quality.

Main Results

- The MSA palatability grading scheme uses a predictive model to assess the eating quality of individual cuts from each carcass and assigns them to a quality class.
- Although the model was developed in Australia using Australian consumers our research showed that it worked equally well for Irish beef and Irish consumers.
- The model was tested over a wide range of carcass types and for three cooking methods (grill, roast and thin slice) with over 1600 consumers tasting over 1100 samples.
- Factors of particular importance to the Irish beef industry (breed, sex, electrical stimulation, aitch-bone hanging, prolonged ageing) were accounted for by the model.
- Boning at 24 versus 48 hours post mortem had a small negative effect on eating quality and this was not accounted for by the model.
- PiVac, a novel method of avoiding cold shortening of hot boned beef (Tenderbound) produced meat of equal quality to cold boning.
- High resolution imaging using hyperspectral imaging can predict eating quality attributes with a high degree of accuracy.
- High oxygen MAP promotes lipid oxidation leading to off-flavours and protein oxidation leading to less tender meat.
- Irish consumers preferred meat from MAP packs with 50% oxygen despite a high level of lipid oxidation.

Opportunity/Benefit

Irish beef processors could use the MSA system to sort beef into quality classes and supply the market with beef of guaranteed quality.

Collaborating Institutions

UCC and UCD

Project Number: 5418

Funding Source: DAFM 04/R&D/TN/256

Date: October, 2013

Project Dates: April 2005 – June 2008

How to Proceed

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UPDATE

Prevalence and Epidemiology of Emergent Strains of Verocytotoxigenic *E. coli* (O157, O26 And O111) in Irish Food Animals at the Pre-Harvest and Harvest Levels of the Food

Key External Stakeholders

Meat and dairy industry, Food Safety Authority of Ireland.

Practical Implications for Stakeholders

Verocytotoxigenic (VTEC) *E. coli*, and in particular serogroup O157, are highly significant food borne pathogens. More recently, other non-O157 VTEC serogroups, in particular O26 O111, O103, and O145 have emerged and been associated with human illness. This project focused on establishing the risk posed by *E. coli* O26, O111, O145, and O103 as well as O157 in ruminant food animals (cattle and sheep) and on their transmission from hide/fleece to meat carcases during the slaughter and dressing

operations. The project also generated data on these pathogens in dairy cattle and raw milk from selected dairy herds. The key message from the study is that *E. coli* O157 remains the most common serogroup. In the meat chain, the hide and fleece are the most important sources of contamination.

Main Results

- **Beef:** *E. coli* O157 was detected in 15.96% of hide, 2.33% of faeces, 0.59% carcass (pre-wash), 0.63% (post-wash) and 3.03% environmental samples. The majority of isolates were highly virulent. *E. coli* O26 was isolated from 0.25% of hide, 1.48% of faeces and 0.56% of environmental samples but no other sample types. *E. coli* O145 was isolated from 0.74% of faeces samples and 0.56% of environmental samples but not on carcass surfaces. *E. coli* O111 was not detected in any of these samples. Of the non O157 serogroups, only a small proportion were virulent.
- **Sheep:** *E. coli* O157 was found in 1.0% of fleece and 0.8 % of carcass samples. *E. coli* O26 was recovered from 2.4 % of fleece, 1.8% of carcass and 4.1% of environmental samples. O103 was found in 16.0% of fleece and 12.6% of carcass swabs and *E. coli* O145 was recovered from 0.2% of fleece samples. *E. coli* O111 was not detected in any of the samples processed.
- **Dairy:** 1% of dairy faecal samples contained O157, O26 or O103 strains but none of the milk or milk filter samples yielded any virulent isolates.

Opportunity/Benefit

Advice, consultancy work and/or research can be provided by Teagasc on Verocytotoxigenic *E.coli*

Collaborating Institutions

University College Dublin, Cork County Council Veterinary Unit

Project Number: 5555

Funding Source: DAFF (05/R&D/D/364)

Date: January, 2011

Project Dates: Jun 2006 – May 2009

How to Proceed

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UPDATE

Probiotic Lactobacilli Survival and Impact in the Animal Gut

Key External Stakeholders

Animal feed manufacturers; thoroughbred racehorse industry, veterinary health professionals.

Practical Implications for Stakeholders

- This project provides first time information on the microbial ecology of the equine, and other mammalian species gut.
- This project also provides information on commensal lactobacilli found in the gut microbiota of humans and animals.

Main Results

- The project provided definitive genome-based evidence to support the fermentation patterns of sixteen strains of *Lactobacillus ruminis*, and has identified prebiotic carbohydrates with the potential to promote *L. ruminis* growth *in vivo*.
- This project identified the core faecal microbiota of ruminants, hindgut fermenters and mono-gastric animals co-localised to a single farm in Ireland.
- The project provided details for the first time, on the faecal microbiota of thoroughbred racehorses, both active and at rest.
- Analysis of the thoroughbred horse microbiota has revealed *Lactobacillus equi* to be a predominant *Lactobacillus* species in the hindgut. Genome analysis identified genes and enzymes highlighting *L. equi* adaptations to the herbivorous gastrointestinal tract of the horse, including fructan hydrolases.
- Having sequenced the genome of *Lactobacillus equi*, will help to further understand the microbial ecology of the equine hindgut and the influence lactobacilli have on it.

Opportunity/Benefit

The outcomes of this project is of relevance for the basic understanding of commensals/probiotics, potential mammalian applications, and potential alternatives to in-feed antibiotics for the animal production industry and generation of information of direct relevance for human probiotic consumption.

Collaborating Institutions

Teagasc and University College Cork

Project number: 5972

Date: Summer 2014

Funding source: Science Foundation Ireland

Project dates: Sept 2008 – Aug 2013

How to Proceed

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UPDATE

Product Reformulation and *In Vitro* Testing of Low Glycaemic Breads

Key External Stakeholders

Food ingredients companies, bakeries, millers, food manufacturers, consumers.

Practical Implications for Stakeholders

Significant findings of the research conducted in this project include detailed information on a range of low glycaemic index (GI) grains and fibres/flours, and their application in novel low glycaemic index (GI) bread formulations. How these fibres behave under mixing, proofing and baking conditions has been assessed, and their shelf life (texture) and sensory properties have been established. This project has led to the development of new, high quality, low GI bread formulations.

A large number of new bread recipes containing a range of different low GI ingredients have now been formulated, and information is now available relating to the optimal water addition and mixing characteristics,

and expected bread, shelf life and sensory properties of the products. Both quantitative and qualitative sensory trials have shown that low GI flours may be introduced into a wheat bread formulation without significantly negating the sensory properties of the resulting breads.

Main Results

- Compositional characterisation of low GI grains.
- Flour blending and baking methods for new low GI bread formulations.
- Sensory properties of new low GI formulations.
- Fundamental rheology, baking and molecular aspects of the new formulations.
- An *in vitro* method for calculating the glycaemic index of the formulations.
- Scientific and technical publications describing the research methods and how the results and formulations may be utilised by an end-user.

Opportunity/Benefit

Advice, consultancy work and/or technical services, relating to the methods and/or formulations developed during this project can be provided at Teagasc Food Research Centre, Ashtown, particularly in the areas of cereal chemistry, dough rheology and baking processes.

Collaborating Institutions

University College Cork

Project number: 5714

Funding source: DAFF (06/R&D/TAFRC/522)

Date: March, 2012

Project Dates: Oct 2006 – Mar 2010

How to Proceed

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UPDATE

Production and Human Health Benefits of Beef Enriched with Conjugated Linoleic Acid (CLA)

Key External Stakeholders

Beef producers/processors, Bord Bia, Health professionals.

Practical implications

Strategies to manipulate the fatty acid composition of beef and the implications of the modified beef on the health of the consumer were examined.

- The findings will assist the beef industry in the production of beef with enhanced fatty acid composition from a human health perspective.
- The findings will also assist the marketing of Irish grass-produced beef.

Main Results

- Supplementation of grazing cattle with plant/marine oils increased the levels of total and the cis9, trans11 isomer of CLA in beef.
- The shelf-life of the modified beef was unaffected.

Beef derived CLA was beneficial in increasing insulin sensitivity in a rodent model of obesity.

Opportunity/benefit

The feasibility of increasing the nutritional value of Irish beef beyond that found in conventionally produced beef was demonstrated. This, together with evidence that nutritionally enhanced beef had beneficial effects in a mouse model of human disease provides an opportunity for the development of functional beef and beef products. The future challenge is to develop production strategies to enhance the nutritional value still further and marketing strategies to capture this potential value to the producer and the consumer.

Collaborating Institution

UCD, TCD, MTT Finland

Project Number: 5213

Funding Source: Teagasc

Date: June 2013

Project Dates: Jan 2004 – Dec 2007

How to Proceed

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UPDATE

Production of Microbial Metabolites by Gut Bacteria

Key External Stakeholders

Food manufacturers, dairy industry, pharmaceutical companies, research communities; public health agencies and health professionals; policymakers.

Practical Implications for Stakeholders

- Availability of probiotic bacteria and functional foods enriched in probiotics and beneficial microbial metabolites with potential beneficial effects on gut health, metabolic health and in reducing allergy onset.

APC Microbiome Institute
Interfacing Food & Medicine

Main Results

- This research led to the identification and exploitation of human gut bacteria for production of a wide range of bioactives such as conjugated linoleic acid (CLA), short chain fatty acids (SCFA), exoploysaccharides and gamma-amino butyric acid (GABA).
- A range of potential probiotic bacteria shown to exhibit health benefits to gut, metabolic and cognitive health, based on cell-based bioassays, and in vivo studies are available as a result of this work.

Opportunity/Benefit

The development of Functional Foods enriched in probiotic bacteria and beneficial microbial metabolites for health promotion and extension of the range of added value specialized functional foods and dietary ingredients with health claims.

Collaborating Institutions

University College Cork

External Collaborators

Prof. Fergus Shanahan, Prof. Ger Fitzgerald UCC, Prof. Tony Ryan, Gene Dempsey, Brendan Murphy, Prof. Eamonn Quigley, Prof. Ted Dinan, Prof. John Cryan.

Project number: 5274

Date: Nov 2014

Funding source: SFI_APC

Project dates: Jan 2008 – Dec 2013

How to Proceed

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UPDATE

Properties of Nano-fibrillar Whey Proteins

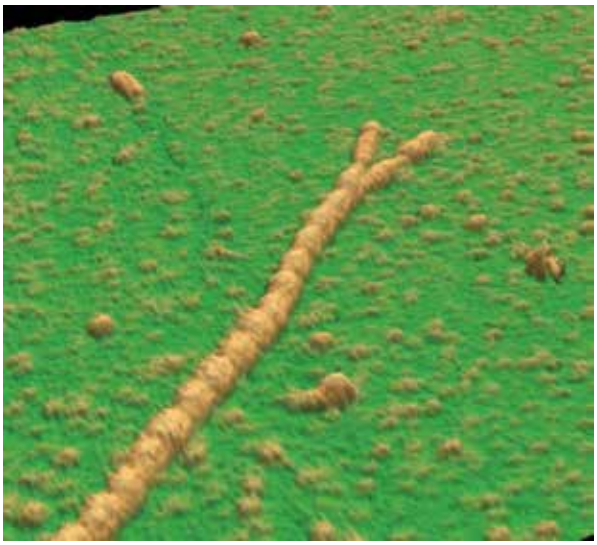
Key External Stakeholders

- Dairy Industry.
- Food and Ingredient Manufacturers.
- Biotechnology companies.
- Academic Institutions.

Practical Implications for Stakeholders

The main objective was to produce fibrillar whey proteins at the nano-scale and assess their potential as functional ingredients. Main outcomes included:

- Optimised conditions for producing stable nanofibrillar whey proteins.
- Nanotechnology expertise in characterising the structure and formation mechanism of fibrillar proteins.
- Shown that nanofibrils can be used to create low salt gels, foams and biofilms.
- Development of nano-fibrils into a spray dried ingredient.



- Established a research platform of expertise in food nanotechnology.

Main Results

- Mechanism for forming nanofibrillar whey proteins has been established.
- Functionality of the nanofibrils has been assessed.
- Spray dried nanofibrils have been produced.
- New atomic force microscopy expertise has been gained.

Opportunity/Benefit

This has established Ireland's first food nanotechnology platform based on nano-engineering food structures. Whey-based nanofibrils have unique functionality, in particular they are excellent foaming agents that can be used to replace more expensive ingredients such as egg-white. In addition, nanofibrils can be used as texturing agents in food products, for example to produce low-salt gels.

Collaborating Institutions

Materials and Surface Science Institute, University of Limerick

Institute of Food Research, Norwich

Wageningen University

Project number: 5607

Date: September, 2013

Funding source: DAFM (06/RDT/MFRC/432)

Project dates: Oct 2006 – Mar 2010

How to Proceed

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UPDATE

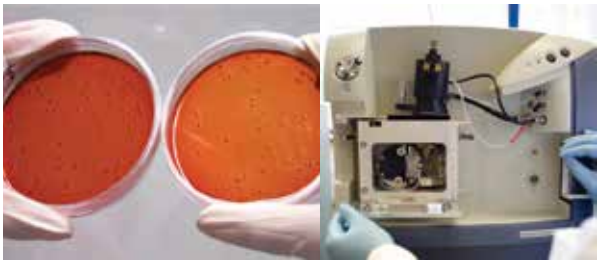
ProSafeBeef: Assessment of Microbiological and Chemical Safety of Beef

Key External Stakeholders

Beef sector, Regulators, FSAI

Practical Implications for Stakeholders

This research study indicated that the risk posed by the microbial pathogens and chemical residues examined in beef was generally low. Nonetheless the study showed that the hide was an important vehicle of microbial pathogen contamination into the abattoir and would thus be a key target for risk reduction measures. A new technology for anthelmintic drug residues was developed and is now in use by the Irish national reference laboratory.



This research was carried out as part of a multi-national EU Framework project, *ProSafeBeef* which focused on research and innovation to improve beef safety and quality. Research on beef safety at Teagasc focused on the risk posed by microbial pathogens and chemical residues in beef.

Main Results

- The occurrence of verocytotoxigenic *E.coli, Listeria monocytogenes, Campylobacter* and *Salmonella* in the beef chain was low. However many of the isolates that were recovered had traits similar to those seen in human illness-causing strains, highlighting the need for continued vigilance in the risk management of such pathogens along the beef chain (farm to fork).
- In this study *E.coli* 0157, the most common type of VTEC in human illness, was also the most commonly recovered VTEC from beef. Emergent serogroups were recovered at a lower prevalence, and the majority of these isolates did not have the combination of virulence genes typically seen in human disease-causing strains.
- During slaughter, it was shown by genetic finger-printing that, the source of pathogens on a carcass could be from an animals own hide or from the hide of other animals being slaughtered on the same day, highlighting that the hide is a key target in the chain for interventions.
- A new state-of-the art Mass Spectroscopy (UHPLC-MS/ MS) method was developed for the detection of 38 anthelmintic drug residues. This accredited method was then applied to assess occurrence of anthelmintic residues in 1061 retail beef samples from across Europe over a two year period. Results showed that the risk of exposure to EU consumers from anti-parasitic drug residues in beef was negligible.

Opportunity/Benefit

The study showed that the hide was an important vehicle of microbial pathogen contamination into the abattoir and would thus be a key target for risk reduction measures. A new technology for anthelmintic drug residues was developed and has been transferred to a number of EU laboratories, thus harmonizing the approach of residue control for beef consumed by EU consumers. This research underpins the safe image of EU beef, ensuring consumer confidence and safeguarding international investment in the sector.

Collaborating Institutions

See full Technology Update at www.teagasc.ie/publications

Project Number: 5705

Funding Source: FOOD-CT-2006-36241

Date: September, 2013

Project Dates: March 2007 to Dec 2012

How to Proceed

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UPDATE

Protecting Consumer Choice: Ensuring the Provenance of Artisan Foods Produced on the island of Ireland.

Key External Stakeholders

Artisan cheese producers; food processors; retailers; regulatory agencies; public analysts.

Practical Implications for Stakeholders

Protection of Brand Ireland is of critical importance for the ingredients and processed foods industries. Artisan cheese production in Ireland has grown considerably over the last decade and has established a reputation for high quality. Linkage of production to local raw materials is a key characteristic of this developing enterprise sector. Development of appropriate analytical means to confirm the provenance of such finished cheeses would represent a key support for companies and lay some of the foundations to support a geographic designation label should any such be desired in the future. Meat products are ideal vehicles for fortification with extra protein, vitamins and minerals and reformed products will provide enhanced and targeted nutrition to promote healthy ageing and vitality in the older population.

Main Results

- A representative sample set of Irish artisanal cheeses has been collected on two occasions over a 12 month period.
- Baseline data describing the content and variability of 11 elements (Na, Mg, P, K, Ca, Mn, Fe, Cu, Zn, Se and Mo) have been established.
- Corresponding data for ratios of naturally-occurring isotopes (H, C, O and N) are being collected.
- Preliminary results indicate that it may be possible to discriminate artisan cheeses produced on the island of Ireland from those produced on mainland Europe. Separation of cheeses produced in Ireland from those originating in Great Britain may not be possible.
- Currently, data collection and full mathematical analysis are being completed.

Opportunity/Benefit

Any successful application for geographic origin status within the EU will require, among other things, the demonstration of a verified analytical capability to confirm the claim being made. This project aims to demonstrate one potential approach to achieve such a capability. This approach mirrors that used successfully for the monitoring of Grana Padano cheeses in Italy for geographic provenance infringements by an industrial consortium. This general analytical approach is capable of being applied to many food products to confirm geographic origin and other authenticity characteristics.

Collaborating Institutions

Queen's University Belfast

Project Number: NFDT-0101-6557

Funding Source: *safe*food

Date: 11/05/2015

Project Dates: 01/09/2013-31/07/2015

How to Proceed

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UPDATE

Proteome Analysis to Improve Meat Tenderness

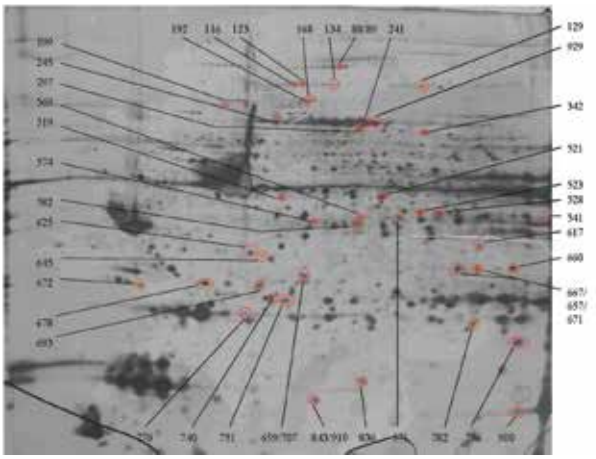
Key External Stakeholders

Meat processors, scientific community, government agencies.

Practical Implications for Stakeholders

The main outcomes from this research relate to the increased understanding of factors underpinning variability in meat tenderness, with novel proteins identified, and information which will support optimisation of postmortem carcass management.

- Identification of a novel biochemical pathway which is of relevance to the development of tenderness in beef and pork.
- Increased understanding of known biochemical pathways influencing tenderness.
- Optimising postmortem interventions: importance of factors such as muscle composition, genetic makeup and animal age.



Main Results

- Structural protein degradation, metabolic enzyme systems and cell defense capability in early postmortem muscle contribute to final tenderness differences in beef and pork with a novel protein identified in cell defense pathways.
- Differential protein profiling was observed in response to postmortem interventions, in particular indicating the importance of intramuscular fat levels and the genetic makeup of the animal when using electrical stimulation.
- Tenderstretch influenced collagen solubility in both muscles while the total collagen content was not change. Microstructure analysis suggests that a greater separation of the myofibres did observed following tenderstretch treatment.

Opportunity/Benefit

Knowledge gained from this project could be beneficial in enhancing current grading systems to incorporate a tiered pricing system in terms of tenderness, and defining optimal postmortem intervention practices to provide assurance of tenderness to meet market demand.

Collaborating Institutions

University College Dublin

Project Number: 5422

Funding Source: DAFF (R&D/TN/254)

Date: March, 2012

Project Dates: Apr 2006 – Mar 2009

How to Proceed

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UPDATE

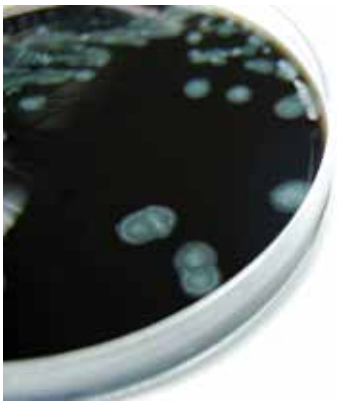
Public Health Significance of Emergent *Campylobacter* Species in the Irish Food Chain

Key External Stakeholders

Pork industry, poultry industry, public health laboratories, Food Safety Authority of Ireland.

Practical Implications for Stakeholders

Campylobacter spp. is the most common cause of bacterial food borne illness in Ireland. It was considered up the mid 2000's that infection was almost exclusively linked to just two species, *C. jejuni* and *C. coli,* but new methods capable of detecting 15 other species of the pathogen indicated that these emergent species were also causing human illness. This study investigated the occurrence and human virulence potential of emergent *Campylobacter* species in Irish pork, poultry and human clinical stool samples. The key finding was that these emergent species are indeed widely prevalent in the food chain and have virulence factors which indicate their public health importance.



Main Results

- *Campylobacter* was detected in pig gut (caecal) contents (34.7%), pre chill pork carcasses (17%), pork cuts (9.5%) and chicken pieces (68%) with a wide range of species present across all sample types including *C. coli, C. jejuni,* and emergent species *C. lari, C. upsaliensis, C. mucosalis, C. curvus, C. sputorum, C. concisus, Arcobacter butzleri*, *Arcobacter Skirrowii.*
- *Campylobacter* was found in 4.8% of previously undiagnosed human clinical samples with emergent species *C. concisus* the second most common species recovered after known species *C. jejuni*.
- The majority of emergent species isolated had virulence genes typically found in known *C. jejuni* and *coli* giving further evidence of a link to human illness.
- *Campylobacter* isolates recovered from poultry and beef were genetically identical to isolates recovered from human stools. Isolates recovered from pork were less similar, indicating that the pork has less of a role in the transmission of human disease causing strains than other commodities.

Opportunity/Benefit

Advice, consultancy work and/or research can be provided by Teagasc on *Campylobacter*.

Collaborating Institutions

Public Health Laboratory at Cherry Orchard Hospital

Project Number: 5553

Funding Source: DAFF (05/R&D/TN/356)

Date: September, 2010

Project Dates: Jul 2006 – Jun 2009

How to Proceed

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UPDATE

Rapid Methods for Detection of Anti-Protozoan Drugs

Key External Stakeholders

Meat, egg and poultry sectors, feed mills, regulatory agencies, e.g. DAFF, FSAI, IMB.

Practical Implications for Stakeholders

The objective of this research was to develop and validate a range of rapid methods for detection of three key anti-protozoan drug residues – diclazuril, halofuginone and toltrazuril. The technologies currently available for residue detection are often highly specialised (and costly) and generally not suitable for application within industry. Therefore low-cost, effective means of screening such components will benefit food producers. A comprehensive liquid chromatography method was developed to detect 21 anti-protozoan and anticoccidial residues in eggs and meat and validated to meet EC 2002/657 criteria.

Anti-protozoan drugs are used in the treatment of Eimeria and Cryptosporidium parvum infections in poultry, pigs, lambs and calves. Residues of these drugs can occur in food because of feed contamination or failure to observe withdrawal periods

following administration. To date, there has been little knowledge on the incidence of antiprotozoan drug residues in food of animal origin due to the lack of suitable analytical methods and the difficulty in analysing these substances. This new development therefore has significant implications for meat, egg and poultry sectors and can be applied to the detection of anti-protozoan drug residues within food at factories, feed mills, or on-line processing monitoring in large-scale food production plants.

Main Results

- Novel antibodies were developed to halofugionone and diclazuril.
- A range of biosensor assays were developed for these residues including a novel multiplex immunoassay, capable of simultaneous detection of diclazuril, halofuginone and toltrazuril.
- A comprehensive liquid chromatography method was developed and validated to detect 21 anti-protozoan and anticoccidial residues in eggs and meat.

Opportunity

A new analytical test was developed and validated to detect 21 anti-protozoan and anticoccidial residues in eggs and meat. This comprehensive test is currently the best available for these residues and is now available as a commercial service to the Irish food industry to ensure that they are in compliance with HACCP and their produce is safe.

Collaborating Institutions

Dublin City University

Project Number: 5578

Funding Source: DAFF (06/RDCU478)

Date: July, 2011

Project Dates: Sep 2006 – Aug 2010

How to Proceed

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UPDATE

Rapid Methods for Food Authentication and Quality Confirmation

Key External Stakeholders

Food manufacturers, consumers, regulatory agencies.

Practical Implications for Stakeholders

The outcome is a clear indication of the power and utility of rapid, non-destructive spectroscopic methods for demonstrating conformance to specification of foods and food ingredients.

- Variations in raw material quality may be detected and defective material rejected.
- In-process changes may be mapped and controlled.
- Final product consistency may be measured and assured.
- This technology facilitates the application of PAT (Process Analytical Technology) in the food industry.

Main Results

- Spectroscopic models have been developed which are capable of discriminating between closely-related food products e.g. extra virgin olive oils from Liguria and other regions in Italy, Corsican honey and honey from neighbouring territories.
- A spectroscopic method for confirming the identity of a branded product was demonstrated. Spectroscopy combined with mathematical modelling has been demonstrated to be suitable for demonstrating conformance to specification in a range of food products.

Opportunity/Benefit

By interaction with this expertise at Teagasc Food Research Centre Ashtown, food processors can reduce variability in the functional and other characteristics of their products, and move towards a PAT approach in food processing.

Collaborating Institutions

See full Technology Update

Project Number: 5430

Funding Source: FP6 (2003-Food-2A-0060942)

Date: January, 2011

Project Dates: Jan 2005 – Dec 2011

How to Proceed

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UPDATE

Ready-to-bake Mixes Containing Healthy Flours Generated from Food Processing By-products

Key External Stakeholders

Food manufacturers, bakeries, food ingredient companies.

Practical Implications for Stakeholders

The by-product material from food processing, and their use as functional ingredients, is an area that is currently attracting much interest. Information available on the characteristics of food by-products is comprehensive; however, information on the stability and shelf-life of food by-products is limited. The research findings from this project add to the scientific and technical knowledge base, and are of value to those in the scientific/research community and food industry who have an interest in the area of functional ingredients.

The project took an innovative research approach in assessing the properties of by-products as ingredients in bakery mixes, and when packaged using different materials. This resulted in the development of new 'ready to bake' mixes containing novel ingredients.

Main Results

Flours derived from the dried by-products of food processing, in particular apple pomace, orange pomace and brewer's spent grain, were incorporated as baking ingredients into the following ready-to-bake mixes:

- A soda bread mix containing 10% brewer's spent grain (BSG) flour (flour weight basis) and wheat flour.
- A yeasted brown bread mix containing 10% BSG and wheat flour.
- A scone mix containing 10% apple pomace (AP) flour and wheat flour.
- A cake/muffin mix containing 3.5% orange pomace flour (OP) and wheat flour. OP flour also replaced 40% of the fat normally used in a cake recipe.

The by-product flours were found to be suitable for incorporation into ready-to-bake mixes. These novel mixes offer a distinct advantage of producing baked products with enhanced nutritional quality (rich in dietary fibre and bioactive compounds) using natural functional ingredients. The flour mixes were stored using a range of different packaging materials, and their shelf life was observed to be highly stable.

Opportunity/Benefit

Outputs from this project include the production of fully characterised and optimised novel bakery mixes ready for evaluation/validation/scale-up by flour/baking companies at a commercial level, while generating a potential profitable market for waste products for the bakery industry.

Project number: 6594

Funding source: DAFM

Date: November, 2015

Project dates: April 2014 – March 2015

How to Proceed

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UPDATE

Red Holsteins – Knowledge of Genetic Variations to Breed a More Robust Dairy Cow

Key External Stakeholders

Dairy farmers, cattle breeders, AI companies, suppliers of mastitis treatments and prophylactics.

Practical Implications for Stakeholders

The main objective of this study was to test the Irish dairy herd for genetic variations in key genes and to determine whether these variations are associated with differences in cow performance. The main outcome is the identification of genetic variations associated with energy balance and fertility. This information can be used in breeding programs to select for more robust dairy cows.

- Of 24 genetic variations tested, 17 exhibited associations with energy balance traits.
- We identified a variant in the milk protein gene, *lactoferrin* that associated with calving interval.
- We detailed the immune response to the probiotic mastitis therapeutic *Lactococcus lactis*.

Main Results

- 17 genetic variations were associated with energy balance in the Irish dairy herd and this knowledge can be used in breeding programs to aid in the selection of dairy cows with shorter periods of negative energy balance in early lactation.
- The significance of finding lactoferrin variants that are associated with calving interval is important in our efforts to improve dairy cow fertility.
- *L. lactis* has been proposed as a probiotic treatment for mastitis. We have proven that, once introduced into the udder, it rapidly stimulates the cow's immune system helping it fight the bacteria that cause mastitis.
- We found no associations between polymorphisms in immune genes with milk somatic cell count. Therefore these polymorphisms should not be used in breeding programmes for improved mastitis resistance in the Irish dairy herd.
- We observed a delayed immune response by the udder when infected with the mastitic bacteria *Streptococcus dysgalactiae* spp. *dysgalactiae*. This will aid in the development of effective therapeutics to treat *S. dysgalactiae* infections, particularly persistent and sub-clinical infections.

Opportunity/Benefit

- Polymorphisms associated with energy balance and fertility can be included in breeding programs to select for more robust dairy cows in the Irish dairy herd.
- Immune signals which exhibited a delayed response to the mastitic bacteria *S. dysgalactiae* are targets for mastitis therapeutics.
- Understanding the mode of action of *L. lactis* as a mastitis therapy is important in our efforts to commercialise this probiotic.
- We have developed expertise in intramammary challenge trials. Queries are welcome from companies interested in performing animal trials to test potential mastitis therapeutic products.

Collaborating Institutions

University College Dublin, University College Cork, Irish Cattle Breeding Federation

Project Number: 5463

Funding Source: Dairy Levy Fund

Date: September, 2011

Project Dates: Mar 2005 – Dec 2009

How to Proceed

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UPDATE

Reducing *Campylobacter* on Poultry Carcasses & Products

Key Stakeholders

Poultry processors, regulatory personnel, scientists, EFSA

Practical Implications for Stakeholders

Campylobacter is the most commonly reported foodborne bacterial pathogen in Ireland and Europe. Poultry is the primary source of *Campylobacter* and this work was conducted to identify carcass decontamination technologies that could be applied to reduce or eliminate this pathogen at the processing stage. The results provide up-to-date information on poultry carcass treatments, including the most effective chemical decontaminants and their respective concentrations. The most appropriate Modified Atmosphere Packaging (MAP) regime that should be used to extend shelf-life and protect public health is also defined.

Main Results

- Dip treatment of broiler carcasses with trisodium phosphate (TSP) will reduce *Campylobacter* levels (by approximately 3 $\log_{10}$ cfu cm^{-2}).
- A cloacal wash with trisodium phosphate, citric or lactic acid did not significantly affect carcass *Campylobacter* counts.
- The use of modified atmospheric packaging (gas mix 40%CO_2:30%O_2:30% N_2) can significantly increase the shelflife of poultry products.

Opportunity/Benefit

This project provides data for risk analysis that may be used to provide the scientific basis for permitting chemical carcass treatments in broiler plants. It evaluated and dismissed cloacal washes as ineffective and identified an MAP gaseous combination that could significant extend shelf-life, thereby reducing wastage and associated cost. The results are available for any interested parties.

Collaborating Institutions

University College Dublin, NUI Galway.

Project Number: 5965

Funding Source: FIRM 08RDTAFRC613

Date: June, 2012

Project Dates: Oct 2008 – Mar 2012

How to Proceed

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UPDATE

Re-Engineering Process Technology for the Manufacture of Infant Formula

Key External Stakeholders

- Dairy Ingredients and Infant Formula Sector.
- Dairy Processing Equipment Manufactures.
- Academic and Research Institutions.

Practical Implications for Stakeholders

The study aimed to re-engineer process technology for the manufacture of infant milk formula (IMF) by modification of formulation dynamics and use of steam shockwave Injector (Maklad-Fluid GmbH) technology:

- A greater understanding of the impact of macronutrient interaction (upon heating) on viscosity during IMF manufacture has been achieved and can be utilised for new formulation development.
- High solids infant formulations can be processed using a shockwave steam injector.
- IMF concentrate manufactured with a selectivity hydrolysed whey protein ingredient has application in high dry matter processes for reduced energy costs and more sustainable processing.

Main Results

The study demonstrated that heat-induced changes in infant formula associated with whey protein (denaturation, viscosity) are not only a function of concentration but are also dependent on interactions between macronutrients. Selectively hydrolysed proteins were shown to be an effective way of reducing viscosity, while maintaining good emulsification capacity, in heat-treated high solids concentrates of 1st age (0 – 6 months) infant formula. A new energy efficient high solids process for manufacture of infant formula with lower viscosity was developed using a shockwave steam injector.

Opportunity/Benefit

The research provides a platform for understanding the heat-induced changes associated with macro-nutrient interactions in IMF for development of new formulations. In addition, technology has been developed for processing formulations at high solids using novel energy efficient approaches based on new ingredients and processing techniques. The new knowledge / process can be exploited by end users i.e., ingredient manufactures and infant, adult and medical nutritional beverage sectors.

Collaborating Institutions

University College Cork, UCC

Project number: 5949

Date: November, 2014

Funding source: DAFM (08/RDT/MFRC/666)

Project dates: Oct 2008 – Feb 2014

How to Proceed

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UPDATE

Releasing the Potential of Bovine Lactoferrin

Key External Stakeholders

Dairy farmers, cattle breeders, AI companies, dairy food companies.

Practical Implications for Stakeholders

- The project results provide genetic information to cattle breeders to select cows programmed to produce higher levels of lactoferrin in milk. These cows are more fertile, have improved milk quality and survive longer in the dairy herd than their herdmates, hence the significant implications to cattle breeders, farmers and AI companies. This project identified cows that naturally produce more of this protein while also showing that different lactoferrin proteins have different levels and types of bioactivity.

- lactoferrin is a bio-active protein found in milk with anti-microbial, anti-cancer, anti-viral and anti-oxidative properties. Milk with increased lactoferrin content or increased lactoferrin bioactivity is an ideal raw material for producing lactoferrin ingredients for the food supplement, infant formula and food safety markets, hence the importance of this research to these sectors.

Main Results

- Associations between genetic variations in lactoferrin with performance traits in 848 Holstein-Friesian sires were quantified. Associations with calving interval, improved survival and lower milk somatic cell score were found. Selecting for these variants in breeding programmes will benefit the health and fertility of the national dairy herd.
- A lactoferrin genotype in cows was identified which produced higher levels of lactoferrin protein in milk.
- The naturally occurring variation in the lactoferrin protein was studied. Six novel lactoferrin proteins were purified from milk of genotyped cows and dried in powder form. Several were found to have enhanced anti-microbial activities against bacterial pathogens *Listeria innocua, Escherchia coli* and *Streptococcus dysgalactiae* compared to current commercially produced bovine lactoferrin preparations.

Opportunity/Benefit

The project outputs are of benefit to the cattle breeding industry through the provision of genetic information to select cows programmed to produce higher levels of lactoferrin in milk. Milk with increased lactoferrin content or increased lactoferrin bioactivity is an ideal raw material for producing lactoferrin ingredients for the food supplement, infant formula and food safety markets. These ingredient producers can benefit from this research also, although further research would be required.

Collaborating Institutions

University College Dublin, Irish Cattle Breeding Federation

Project number: 5582

Funding source: DAFF (06RDTMFRC437)

Date: September, 2011

Project Dates: Nov 2006 – Mar 2010

How to Proceed

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UPDATE

Research Providing a Knowledge Base to Support the Sustainable Development of the Farmhouse Cheese Industry

Key External Stakeholders

Irish Farmhouse Cheesemakers Association, Food Safety Authority of Ireland.

Practical Implications for Stakeholders

This research has had an impact as follows:

- The results of the analysis have been given to each producer giving them valuable information on their product and process.
- Assistance and advice was given to the farmhouse cheesemakers on issues not directly related to the project, facilitating the building of a good working relationship.
- A HACCP workbook is being implemented in the farmhouse cheese sector, which will have implications in the production of safer, higher quality cheese.
- Teagasc are working with the stakeholders to support the setting of limits for flukicides.
- The sector has an understanding of the food safety attributes valued by consumers and the importance in adopting a supply-chain approach when managing food safety policy. This can be used in the development of marketing strategies that will address market requirements.
- The results provide strong positive feedback on the contribution of the regulatory authorities to the artisan food sector.

Main Results

- Cheeses and cheesemaking facilities tested were generally within quality/safety parameters. Support was given to cheesemakers, and pre-emptive action taken where any issues were identified.
- Anti-parasitic drug residues are not an issue in cheeses.
- Consumers have confidence in the safety of Irish farmhouse cheese and its producers, and that the sector is well-regulated. They also perceive it to be a quality product.

Opportunity/Benefit

- Farmhouse cheese manufactured in Ireland is safe and produced in hygienic processing facilities.
- This evidence-base provides an opportunity to build a strong competitive advantage for Irish farmhouse cheese in the domestic and export market.
- A HACCP booklet is available to assist producers in their efforts to continue producing safe high-quality product.

Collaborating Institutions

N/A

Project Number: 5611

Funding Source: DAFF (06/RDT/MFRC/434)

Date: March, 2011

Project Dates: Oct 2006–Mar 2011

How to Proceed

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UPDATE

Retaining Health Benefiting Compounds in Irish Vegetables

Key External Stakeholders

Vegetable growers & processors, functional food manufacturers, government authorities/legislators, consumers, food research scientists.

Practical Implications for Stakeholders

Irish vegetables (carrots, parsnips, broccoli, and onions) when grown and processed appropriately can retain high levels of bioactive compounds that will have salutatory effects on human health.

Main Results

- Novel physical processing pre-treatments showed a significant increase in phytochemical yield. For example an automated pressurised liquid extraction for polyacetylenes was found at 800 psi, 25°C, 3 cycles. Likewise high pressure processing showed to be an attractive technology to process vegetables & vegetable based foods.
- Isolation protocols for polyacetylenes, polyphenols & isothiocyanates have been developed since some of these compounds cannot be bought commercially. Improved high-throughput quantification methods for polyacetylenes,polyphenols and glucosinolates with high efficiency and specificity (LC run time between 10–30 minutes).
- An alternate synthetic route for polyacetylenes was sought and developed. This supplemented low natural abundance for biological tests and helped in establishing the absolute configuration of natural polyacetylenes.

Opportunity/Benefit

There is a great consumer demand for healthy foods that provide health-benefits beyond nutrition (functional food). Three most common Irish vegetables (carrots, broccoli and onions) are known to contain bioactive compounds with various biological functionalities such as anti-cancer, antioxidant, and anti-microbial properties. The outcomes of the project demonstrated that these vegetables can be grown and processed appropriately to serve as excellent functional food resources.

Collaborating Institutions

University College Dublin (UCD)

Dublin Institute of Technology (DIT)

National University of Ireland Galway (NUIG)

University College Cork (UCC)

University of Limerick (UL)

Project number: 5864

Funding source: DAFM

Date: November, 2015

Project dates: Feb 2008 – Nov 2014

How to Proceed

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UPDATE

Retaining Health Promoting Polyacetylenes in Fully Processed Vegetables

Key External Stakeholders

Vegetable processors, government authorities/ legislators, consumers.

Practical Implications for Stakeholders

Technologies for the maximum retention of biologically active polyacetylenes in carrot, parsnips and fennel products were developed in this project. These technologies have been formulated and disseminated to industry stakeholders and recommendations produced for processors.

Results from the project have been formulated into a series of blueprints and fact sheets for end-users. Knowledge gained from the project can be used to formulate processing strategies which will maximise the retention of polyacetylenes in processed foods.

Polyacetylenes are a group of bio-active compounds present in carrots and other vegetables which have

recently gained scientific attention due to their ability to inhibit cancer development in rats. Carrots contain three polyacetylenes; falcarinol (FaOH), falacrindiol (FaDOH) and falcarindiol-3-actetate (FaDOAc). The present project sought to examine effective processing strategies for retaining these compounds in vegetables and facilitated key recommendations to be made to processors and consumers.

Main Results

- During minimal processing, abrasive peeling accounts for most of the losses in polyacetylene levels, when compared to other minimal processing treatments such as cutting and washing. Therefore, to maximise polyacetylene contents in minimally processed carrot products, less severe methods of peeling are recommended.
- The inclusion of a blanching step prior to sous-vide processing resulted in a significant decrease in levels of FaOH and FaDOH in parsnip disks. Subsequent sous-vide processing had little effect on levels of polyacetylene; however, chill storage for up 20 days did result in significant decreases in these compounds. Roasting resulted in significant losses of polyacetylenes from fennel bulb.
- Ultrasound-assisted hot air drying (UAHD) resulted in higher retention of polyacetylenes in dried carrot disks than blanching followed by hot air drying. Given the minimal impact of ultrasound on polyacetylene content and the general negative impact of blanching, ultrasound could be considered as a replacement for blanching.

Opportunity/Benefit

Opportunities arising from the outputs of the project derive from the ability of vegetable processors to optimise processing protocols for the retention of polyacetylenes. A series of recommendations have been made with regard to traditional and novel processing techniques and these can be used to produce premium products with optimal health promoting properties.

Collaborating Institutions

NUI Galway, Natures Best Ltd

Project number: 5711

Funding source: DAFF (06/R&D/TAFRC/518)

Date: March, 2012

Project Dates: Dec 2006 – Nov 2010

How to Proceed

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UPDATE

Risk Assessment Network of Ireland

Industry Impact

The study assessed the impact of two food pathogens on the safety of raw milk cheese for the benefit of raw milk cheesemakers and the public in general. The study showed that risks associated with *Staphylococcus aureus* are low, while those associated with *Listeria monocytogenes* are more significant.

Key External Stakeholders

Raw milk cheese industry; Policymakers, Food researchers.

Practical Implications for Stakeholders

The study assessed the risk posed by two food pathogens (*Staphylococcus aureus* and *Listeria monocytogenes*) in raw milk cheesemaking. A range of samples (n=117), including milk, curds, whey and cheese, from 5 raw milk suppliers, and 4 raw milk cheesemakers were analysed for coagulase positive *S. aureus*. Of the isolates obtained, 17% had toxin producing ability and produced only Staphylococcal Enterotoxin C (SEC) which is generally animal rather than food associated. The other classical enterotoxins SEA, SEB or SED (food poisoning associated) were not produced. No toxin was produced in raw or pasteurised milk or in sterile reconstituted skim

milk stored below 14°C for 24 h and no SEC was produced during cheesemaking. *L monocytogenes* was found at a level of 300 colony forming units/ml in the milk of one cow with sub-clinical infection. While the numbers of naturally occurring *L. monocytogenes* increased in milk and during cheesemaking, this increase did not appear to be due to growth.

This research was carried out as part of a national network, Risk Assessment Network of Ireland which focused on the application of microbial quantitative risk assessment to underpin risk management actions. Teagasc research assessed the risk posed by two pathogens on the safety of raw milk cheese.

Main Results

- None of the *S. aureus* isolates recovered from raw milk or cheese produced the endotoxins SEA, SEB or SED, nor did they harbour the enterotoxin encoding **genes** *sea, seb*, *sed* or *see*.
- 17% of *S. aureus* isolates produced Staphylococcal enterotoxin C (SEC)
- Cheesemaking inhibited staphylococcal toxin production as did storage temperatures below 14°C
- Optimum conditions for toxin production in reconstituted skim milk were 37°C at pH 6.5
- *Listeria monocytogenes* was found in raw milk from one cow at a level of 300 cfu/ml, though there was with no evidence of infection in the animal.
- Although numbers of naturally occurring *L. monocytogenes* increased in milk and during cheese making, this increase did not appear to be due to growth.

Opportunity/Benefit

The opportunity was to assess the impact of *S. aureus* and *L. monocytogenes* on the safety of raw milk cheese for the benefit of raw milk cheesemakers and the public in general. The study showed that there were different risks associated with each pathogen.

Collaborating Institutions

University College Dublin

Project number: 5855

Funding source: DAFM

Date: June, 2014

Project dates: Nov 2007–Nov 2012

How to Proceed

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UPDATE

Safe and Healthy Foods

Key External Stakeholders

Aquaculture, pork, poultry, beef, egg and honey producers; regulatory agencies, retailers, importers, animal health companies, food safety laboratories and consumers.

Practical Implications for Stakeholders

Safe & Healthy Foods programme set out to improve the safety of food consumed or produced on the island of Ireland through the development of new analytical methods and food databases.

A suite of new residue test methods were developed that cover nearly 150 different analytes. The range of compounds covered included veterinary drugs, feed additives, hormonal agents and pyrrolizidine alkaloids in different foods. The application of these tests showed that food consumed on the Ireland is generally of high purity. Residues were detected in a very small proportion of samples rendering them non-compliant. However, >99.6% of samples were residue free. A range of food safety databases were developed or updated on the project including the National Food

Residue Database, Veterinary Drug and Feed Additives Databases (VetFAD) and the Central Microbial Database. A new comprehensive food ingredient database (INFID), which has been used to estimate the intake of four sweeteners (aspartame, saccharin, acesulfame K, sucralose) were within the Acceptable Daily Intake levels for preschool children. The Irish Food Compositional Database was updated with current data on nutrients and bioactive components for a range of different foods.

Main points

- The newly developed databases and technologies will allow stakeholders to significantly improve the safety and quality of food products produced on the island.
- The newly developed tools will allow the stakeholders to more effectively target resources and give better value for money.

Main Results

- New multi-residue test methods developed for nearly 150 contaminant residues in food.
- New databases were developed covering the area of food safety and food consumption.
- Food surveys and exposure assessments were completed showing that the food we eat is very safe.

Opportunity/Benefit

During the project, new knowledge and technologies have been developed that can be used to improve the quality and safety of food products consumed or produced on the island.

Collaborating Institutions

AFBI, QUB, UUJ, UCD, CVRL-DAFM, UCC, CIT

Project number: 5856

Date: November, 2014

Funding source: 07FHRITAFRC

Project dates: Dec 2007 – Dec 2013

How to Proceed

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UPDATE

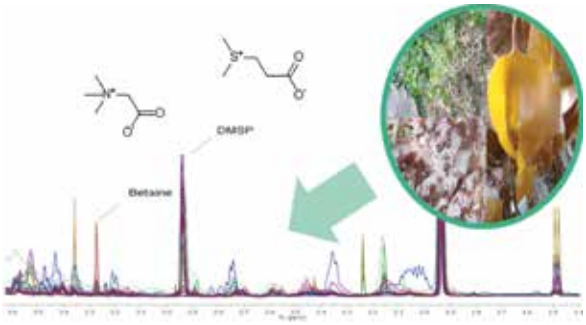
Seaweed Derived Glycine Betaine and DMSP

Key External Stakeholders

Ingredient companies, marine processors, biochemical companies, food companies.

Practical Implications for Stakeholders

Seaweeds are an abundant resource present around the Irish coastline. We have assessed a number of Irish seaweeds, which were harvested by our research partners in NutraMara – NUI Galway. Researchers at Teagasc determined the glycine betaine and DMSP levels in these seaweeds using NMR and MS methodologies.



Glycine betaine obtained a health claim under article 13 of EFSA in 2011 in relation to maintenance of normal homocysteine levels and therefore can be used for this purpose as a functional food ingredient/ capsule ingredient.

Main Results

- Two green seaweeds, harvested from around the Irish coast contained glycine betaine and DMSP.
- A novel, cost-efficient, environmentally friendly methodology was employed to generate fractions containing these zwitterionic compounds.
- NMR method developed to assess the level of glycine betaine and DMSP in the extracts.

Opportunity/Benefit

These extracts could be used in supplements or in functional foods to control homocysteine levels in the blood.

Collaborating Institutions

National University of Ireland, Galway

Teagasc

Project number: NutraMara – The Marine Functional Foods Research Initiative

Date: May 2015

Funding source: DAFM and Marine Institute and Teagasc

Project Dates: October 2009 – December 2012

How to Proceed

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UPDATE

Secondary Cheese Processing

Key External Stakeholders

Irish manufacturers of cheese, processed cheese and milk protein powders, scientists with interest in the field of secondary cheese processing.

Practical Implications for Stakeholders

Key production variables that significantly affect the characteristics of processed cheese products (PCPs) were identified: characteristics of the natural cheeses used, types and levels of emulsifying salts, product pH, and processing conditions. The research provided insights into the mechanisms by which these variables affect PCPs. They alter protein hydration, protein voluminosity and fat emulsification, all of which in turn influence the structure and continuity of the protein network that forms the structural framework of the PCP.

Main Results

Using a given generic formulation and product composition, PCPs with widely different functionalities could be achieved by alteration of natural cheese characteristics, emulsifying salt type and level, product pH and processing conditions.

Processing was accompanied by a large increase in the solubility of the protein of natural cheese and other ingredients (e.g. rennet casein) used in the formulation, as a consequence of emulsifying-salt mediated demineralisation; nevertheless, most of the calcium and phosphorous in PCP remain insoluble in the form of insoluble calcium phosphate or calcium citrate inclusions.

Reducing the level of emulsifying salt below a critical level prevented the successful formation of PCP, owing to insufficient calcium removal from, and solubilisation of, the natural cheese protein.

Increasing processing time, temperature and shear had similar effects on PCP properties, albeit differing in magnitude of effect: significant increases in firmness and elasticity modulus and reductions in the fracture strain and in the flowability and fluidity of the melted PCP.

Opportunity/Benefit

The research provides an extensive database on how the functional properties of PCPs (e.g. texture, rheology and melt characteristics) may be altered by changing different process variables. It provides scientifically supported insights into the mechanisms operating during the manufacture of PCPs, and how these may be modulated for control of potential defects (such as *overcreaming*, oiling-off, low heat-stability) or customisation of product characteristics. This database is available to Irish dairy companies by way of scientific publications and provision of customised workshops.

Collaborating Institutions

N/A

Project Number: 5451

Funding Source: Dairy Levy

Date: February, 2011

Project Dates: Jan 2005 – Dec 2007

How to Proceed

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UPDATE

Sensory Acceptance of Low Salt Ready Meals

Key External Stakeholders

Food manufacturers, food policymakers, food safety policymakers, food researchers.

Practical Implications for Stakeholders

Chilled ready meals are becoming increasingly popular but often contain appreciable amounts of salt. Food manufacturers are under increasing pressure from regulators and consumers to reduce salt in food. The present project focused on the impact of salt reduction and reformulation on sensory acceptability of low salt ready meals.

- The addition of key herbs and spices individually can help compensate for shortfalls in sensory acceptability for chilled ready-meals.
- The addition of salt substitutes into all 3 frozen ready-meals made it possible to achieve the FSAI salt reduction targets of 0.63g salt (250mg sodium) per 100g in ready-meals and 0.58g salt (230mg sodium) per 100g in soup.

- By adopting a gradual salt reduction strategy the following salt reductions could be achieved without adversely affecting sensory properties and consumer preference for the meals.

Main Results

Sensory perceptions of low salt ready meals were investigated and the impact of reformulation on sensory acceptability was probed.

- A number of herb/spice blends were formulated that resulted in satisfactory sensory acceptability in comparison to meals with normal salt contents.
- The use of herbs and spices also increased the microbial stability of the meals and enhanced their antioxidant status.
- In conjunction with an industrial manufacturer the reformulated low salt meals were manufactured and analysed for sensory acceptability using a consumer panel. In all cases the reformulated meals were of comparable sensory acceptability to their full salt counterparts.

Opportunity/Benefit

The outputs of this project have shown that research driven reformulation can off-set perceived losses in flavour as a result of salt reduction. The strategies developed could be applied to a range of prepared foods and identify effective measures for reducing salt levels in foods without comprising on sensory acceptability. Expressions of interest in this research are welcome.

Collaborating Institutions

University of Limerick, Dawn Fresh Foods Ltd., All in All Ingredients

Project number: 5712

Funding source: DAFF (06/R&D/AFRC/519)

Date: March, 2012

Project Dates: Oct 2006 – Sep 2011

How to Proceed

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UPDATE

Status of the Phytochemical Compound, Falcarinol, in Minimally Processed Vegetables

Key Stakeholders

Vegetable processors, government authorities/ legislators, consumers, research community.

Practical Implications for Stakeholders

Recently a group of falcarinol type polyacetylenes were shown to be protective against tumour development in humans. In comparison to other compounds with cancer protective effects, relatively little was known about the occurrence of these compounds in plant foods or the effect of industrial or domestic processing on their retention. This project examined the effect of various production processes (peeling, washing, cutting, packaging and storage) on the level of polyacetylenes in a selection of vegetables

including carrots, parsnips and fennel. Protocols have been developed for the maximum retention of these polyacetylenes in minimally processed vegetables.

Main Results

- The initial washing stage had no effect on polyacetylene levels.
- Significant losses occurred after peeling in carrots.
- The best retention of polyacetylenes was observed in shredded carrots.
- Polyacetylenes were not susceptible to further degradation when subjected to low or high oxygen MAP (modified atmosphere packaging) and stored for 7 days under chill conditions.
- The use of an air-breathable film as opposed to a conventional polyester-polypropylene film did not have a significant effect on levels of polyacetylenes in stored products.

Opportunity/Benefit

The results of this project will allow vegetable processors to optimise processing protocols for the retention of health promoting polyacetylenes in vegetables including carrots, parsnips and fennel.

Collaborating Institutions

NUI Galway, Natures Best Ltd., Wonderfoods Ltd.

Project Number: 5473

Funding Source: DAFF 06RDTAFRC518

Date: August, 2012

Project Dates: Dec 2006 – Nov 2010

How to Proceed

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UPDATE

Studies on the Microbiology and Sensory Properties of Novel Low Sodium Ethnic Ready Meals

Key External Stakeholders

Food manufacturers, cheese producers.

Practical Implications for Stakeholders

- A ready-made meal salt reduction reformulation approach is feasible at manufacturing scale, when combined with microbiological and sensory optimization.
- A market survey revealed that salt levels in ready-made meals were ≥50% of the recommended daily allowances (RDA) for salt in 77% of meals evaluated, with 8 meals containing 100% of the RDA for salt.
- Market surveys also revealed that salt levels were not clearly labelled on most ready-made meals.

- The use of specific commercial salt replacers could facilitate further salt reductions in selected products.

Main Results

- A comprehensive study was undertaken on the microbiological quality of commercial ready-made meals in comparison to reduced salt counterparts. No difference in microbiological populations was evident between ready-made meals with and without salt reduction over controlled storage conditions. This indicates that bacterial survival during commercial processing and frozen storage was not affected by the range of salt levels in full and reduced salt products.
- Evidence of bacterial migration during storage in lasagne ready-made meals was demonstrated.
- Salt levels could be reduced in selected ethnic ready meals by 29–50% without impacting on sensory quality. The difference was dependent upon the product type.
- The use of commercial salt replacers enabled a salt reduction of 48–66%.
- The impact of salt reduction on the quality of Cheddar cheese was assessed and highlighted that incorporating process changes could be used to lower salt levels without adversely impacting on quality.

Opportunity/Benefit

Consultancy and contract research opportunities are available to both national and international clients in salt reduction in processed foods and cheese.

Collaborating Institutions

University of Limerick

Project number: 5437

Funding source: DAFM

Date: November, 2015

Project dates: Jan 2005 – June 2008

How to Proceed

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UPDATE

Survival of *Mycobacterium avium* Subspecies *paratuberculosis* (MAP) in a Raw Milk Smear Type Cheese

Key External Stakeholders

Artisanal farmhouse cheese producers, dairy industry, dairy farmers.

Practical Implications for Stakeholders

Johne's disease is caused by *Mycobacterium avium* subspecies *paratuberculosis* (MAP) and affects cattle, sheep and goats. Because of the similarity of the pathogenesis of Johne's disease in cattle and Crohn's disease in humans there is ongoing debate regarding the potential of animal derived MAP in the food chain to cause Crohn's disease in humans however, this link has never been definitively established.

The main recommendation from this research is that milk from cows suffering from Johne's disease and shedding large numbers of MAP should not be used

for the manufacture of smear type cheese made from unpasteurised milk as these bacteria will survive cheese manufacture and ripening.

Main Results

To establish the fate of MAP in a raw milk smear type cheese the survival of MAP in a smear type cheese made from raw milk and the effect of the natural antimicrobial lacticin 3147 on the survival of MAP were assessed during manufacture and ripening.

- MAP can survive the manufacturing and ripening conditions employed in the making of a raw milk smear type cheese when the milk is artificially contaminated before cheese manufacture.
- The use of a lacticin 3147 producing starter did not affect MAP numbers after 4 weeks of ripening when compared to the control.

Opportunity/Benefit

This research provides important information as the results show that raw milk from cows suffering from Johne's disease and shedding *Mycobacterium avium* subspecies *paratuberculosis* should not enter the food chain if the milk is to be used to make unpasteurised smear type cheese.

Collaborating Institutions

See full Technology Update

Project Number: 5654

Funding Source: EU FP6 (023106)

Date: August, 2011

Project Dates: Oct 2006 – May 2010

How to Proceed

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UPDATE

Technological Advances in Spray Drying of Functional Ingredients for Automated Beverage Vending

Key External Stakeholders

Manufacturers of milk powders and dairy ingredients.

Practical Implications for Stakeholders

Technologies were developed to produce functional powders suitable for reconstitution/dispensing as either hot or cold beverages.

- Installing an in-line high pressure gas/liquid injection system on the concentrate feed to the spray atomiser of a milk-drier facilitated the production of dried ingredients with extensive foaming properties suitable for use in cappuccino-based beverage formulations.
- *Development of foaming powder for hot beverage formulation and vending* – a knowledge-base was established on the performance of different injection gases used and their interactions with concentrate formulation and process variables on powder characteristics.

- *Development of cold mixed smoothie-style beverages from textured dairy-fruit dry blends* – 'smoothie' style powders containing fruit/dairy ingredient blends with desired physical characteristics e.g. texture, viscosity and phase stability were successfully developed for dispensing in prototype vending machines.

Main Results

The immediate effect of using either nitrogen gas or liquid CO_2 injection during atomisation, was improved powder agglomeration and an associated decline in bulk densities (from 0.56g/cc to 0.12g/cc) as well as reduced moisture contents. This was also reflected in changes to the particle size distribution and particle density – the latter reduced from 1.2334g/cc to 0.599g/cc.

Interrelationships were established between drying parameters and powder properties (bulk density, particle size distribution, occluded air, interstitial air, particle density, wettability, foam height using a coffee dispenser at t=0 min, foam height after 5 min, and moisture content) specific to cappuccino beverages. Significant relationships, in particular, were established between powder bulk density and cappuccino foam stability using CO_2 (foam stability = 5.556-(5.532*Bulk Density)) and N_2 (foam stability = 5.017-(4.573*Bulk Density)) dosing.

Opportunity/Benefit

This research provides the opportunity to add functionality and value to spray dried ingredients. This technology may be incorporated, with some adaptation by ingredient drying manufacturers, to prepare fat-filled base or fully-formulated powders for supply to branded food companies with channel dominance in food service markets. Relevant pilot scale technologies at Moorepark may be availed off to support technology transfer initiatives.

Collaborating Institutions

N/A

Project Number: 5435

Funding Source: FIRM 04/R&D/TD/320

Date: Nov, 2012

Project Dates: Jan 2005-Sept 2008

How to Proceed

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UPDATE

Technology for Healthier Pork Products

Key Stakeholders

Meat processors, ingredient companies, consumers

Practical Implications for Stakeholders

Traditional meat products such as sausages and cooked ham are often high in fat, salt and contain additives to prolong shelf life, improve colour and prevent oxidation. The information generated in this project will assist meat processing companies to develop healthier products, such as sausages and luncheon role, containing less salt and/or fat and containing natural ingredients that will appeal to consumers.

Main Results

- High pressure processing (HPP) can be used to reduce the salt content of pork sausages from 2.5% to 1.4% without a noticeable change in sensory and functional properties.
- A phytosterol ester *(Vegapure*) was used successfully to improve the organoleptic properties of a reduced salt pork breakfast sausage.
- Grape seed extract (GS) and rosemary-pomegranate (RP) extract were added to sausages without any negative effect on the sensory quality of the products, demonstrating the potential of natural flavonoid containing extracts in the development of novel healthy functional meat products.
- Half the nitrite in a pork luncheon roll was replaced with tomato powder without negatively affecting sensory attributes.

Opportunity/Benefit

Meat products are commonly perceived by consumers as unhealthy due to their high fat, salt and artificial ingredient content. This research has shown that healthier versions of traditional meat products, such as sausages and pork luncheon roll, can be produced that are just as acceptable to consumers as standard versions of the same products. There are opportunities for the meat industry to:

- Reduce the salt, fat and nitrite levels in certain processed pork products,
- Replace artificial antioxidants with natural ones,
- Incorporate phytosterol esters with positive health associations.

Teagasc can offer assistance in the development of these products.

Collaborating Institutions

IRTA Spain, University of Copenhagen, University of Helsinki

Project number: 5718

Funding source: EUFP6

Date: November, 2012

Project Dates: Jan 2010 – Dec 2011

How to Proceed

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UPDATE

The Anti-inflammatory Effect of Algal Lipid Extracts

Key External Stakeholders

Consumers, society, government authorities/ legislators and food industries.

Practical Implications for Stakeholders

Inflammation is a biological process that contributes strongly to a number of chronic diseases such as cardiovascular disease. Seaweeds and microalgae are potent sources of bioactive ingredients such as omega-3 polyunsaturated fatty acids (n-3 PUFA) and pigments which, as dietary ingredients have shown strong potential to prevent inflammation. This project identified the anti-inflammatory effect of algae extracts from the Irish coast.

Main Results

- Lipid extracts of four algal species contained a broad range of fatty acids including n-3 PUFA (34–62g/100g total fatty acids) and a broad range of pigments including chlorophyll *a* and *β*-carotene.
- *Palmaria palmata* extract significantly inhibited the production of the inflammatory cytokine IL-6 and IL-8 and *Pavlova lutheri* extract significantly inhibited the production of the inflammatory cytokine IL-6 in lipopolysaccharide stimulated human THP-1 macrophages.
- Moreover, all four extracts (*Pavlova luther, Palmaria palmata, Porphyra dioica* and *Chondrus crispus*) downregulated the expression of a number of inflammatory genes in the macrophages.
- Out of the four species tested, *P. lutheri* posed the greatest potential as a functional anti-inflammatory ingredient.
- This study suggests that algal lipid extracts may inhibit the production of inflammatory cytokines and the expression of inflammatory genes and thereby alleviate the symptoms of inflammatory disease.

Opportunity/Benefit

The algae extracts studied exhibited anti-inflammatory effects and are natural sources of bioactive components. The present study identifies the potential of these extracts for use as functional food ingredients aimed at inhibiting chronic disease-associated inflammation.

Collaborating Institutions

Teagasc Food Research Centre, Moorepark

National University of Ireland, Galway

University College Dublin

Project number: MFFRI/07/01

Date: November, 2015

Funding source: Marine Institute and DAFM

Project Dates: 2007–2013

How to Proceed

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UPDATE

The Effect of Diet on *Salmonella* Survival in the Bovine Rumen and Abomasum

Key External Stakeholders

Beef farmers, beef processors, FSAI, DAFM and EFSA.

Practical Implications for Stakeholders

The aim of this study was to examine if diet could be used as a pre-harvest control strategy aimed at reducing the risk of *Salmonella* contamination at slaughter. This study concluded that dietary manipulation is not an effective means of reducing *Salmonella* carriage and shedding in beef animals.

Main Results

Although the high grain diet resulted in significantly higher volatile fatty acid (VFA) concentrations in the rumen, overall diet did not affect *Salmonella* survival in the rumen, abomasum nor the faeces. Dietary manipulation is not an effective strategy for reducing *Salmonella* carriage and shedding in cattle.

Opportunity/Benefit

The hypothesis that diet may be manipulated to reduce *Salmonella* carriage and shedding in cattle thereby reducing carcass contamination levels, protecting public health, exports, etc. was tested in this project and shown to be ineffective. The results are available for interested parties.

Collaborating Institutions

University College Dublin

Project Number: 5635

Funding Source: DAFF (06RDTAFRC471)

Date: June, 2011

Project Dates: Dec 2006 – Dec 2009

How to Proceed

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UPDATE

The Milk Proteome: A Tool for Understanding Milk Quality and Functionality

Key External Stakeholders

Cheese manufacturers.

Practical Implications for Stakeholders

- This study thus has a very high relevance for the Irish cheese industry, and its need to supply high quality products over the whole year. As milk composition changes over the lactation cycle, milk at late lactation stage is less suitable for cheese manufacturing due to the changing plasmin levels.

Main Results

- We clearly demonstrated differences in proteolysis in cheeses made from milk taken over different stages of the lactation cycle.
- From this study, it could be seen that there are significant changes in the profile over the lactation cycle and, while similar studies have been done on this topic, the application of proteomic tools gives another a deeper insight into the specific changes occurring due to proteolysis.
- Proteomics is a very helpful tool to characterize the differences between cheese samples during ripening and also over lactation.

Opportunity/Benefit

This project has developed significant additional research capacity in a very new field (proteomic analysis of food systems) which offers new advanced analytical capability of interest in the context of a range of new research project areas, including analysis by food companies. In addition, the project involved applying these tools to applied research questions of direct scientific and industrially-relevant interest (e.g., impact of seasonality and somatic cell count on dairy product quality). Additional knowledge on milk quality issues is of indirect economic impact by providing additional knowledge for dairy companies in Ireland.

Collaborating Institutions

Teagasc and University College Cork

Project number: 5550

Date: Spring 2014

Funding source: FIRM

Project dates: Mar 2005 – Sept 2008

How to Proceed

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UPDATE

The Potential of Yoghurt as a Functional Food Matrix for an Omega-3 PUFA-rich Algae Extract

Key External Stakeholders

Consumers, society, government authorities/ legislators and food industries.

Practical Implications for Stakeholders

Omega-3 polyunsaturated fatty acids (n-3 PUFA) are bioactive ingredients that have anti-inflammatory, cardioprotective and cognition-enhancing properties. Seaweeds and microalgae are potent sources of n-3 PUFA and provide a novel vegetarian source of these ingredients over fish. This project identified the potential of yoghurt as a carrier-food for omega-3 rich algae extracts.

Main Results

- A lipid extract from the microalgae *Pavlova lutheri* was obtained and analysed for its fatty acid content (51g n-3 PUFA/100g total fatty acids)
- Addition of the extract (at 0.25% or 0.5%) to the yoghurt did not significantly affect pH, rheology, whey separation, starter culture survival or macronutrient composition over 28 days.
- Colour of the yogurt was significantly affected by addition of the extract at 0.25% and 0.5%
- Addition of the extract to the yoghurt at both concentrations was associated with altered sensory properties.
- n-3 PUFA concentrations were significantly increased following addition of the extract to the yoghurts at 0.25% and 0.5%.

Opportunity/Benefit

Addition of a *P. lutheri* lipid extract to yoghurt did not impact the techno-functional properties of the yoghurt, while colour and sensory properties were significantly altered. The present study suggests yoghurt as a potentially suitable food-carrier for algal extracts and as a novel vegetarian source of n-3 PUFA.

Collaborating Institutions

Teagasc Food Research Centre, Moorepark

National University of Ireland, Galway

University College Cork

Project number: MFFRI/07/01

Date: November, 2015

Funding source: Marine Institute and DAFM

Project Dates: 2007–2013

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UPDATE

The Use of Novel Processing Technologies for Improving the Quality and Accelerating the Processing of Meats

Key External Stakeholders

Meat processors, retailers.

Practical implications

Meat curing is one of the oldest meat preservation methods and it is still widely used today to produce a range of meat products with desirable characteristics. However, brine penetration into meat is a slow process so most processors use multi-needle injectors to produce bacon and ham in a few days rather than a few weeks. However, this produces products of lower quality. We have shown that the rate of brine penetration can be speeded up be applying high intensity ultrasound (US) to the meat while it is immersed in brine. Processors could use US to shorten processing times without adversely affecting the quality. Pulsed electric fields (PEF) is another novel technology with potential, but we have found that it is not as effective as US.

Main Results

- In lab-scale studies a range of US treatments (10, 25 or 40 min at US intensities of 4.2, 11 or 19 W cm^{-2}) increased the salt content of pork.
- Diffusion studies confirmed that the rate of salt uptake was increased by US treatment.
- In pilot scale studies (pork pieces of 300g approx.) three US treatments (2 h; 10.7, 17.1 or 25.4 W cm^{-2}) halved the time to reach a salt content of 2.2%
- US treatment did not affect any quality attributes.
- PEF treatment of pork prior to curing increased the slat uptake but only by about 17%
- US is easier to apply to meat pieces than PEF and it showed greater potential for reducing curing times.

Opportunity/benefit

Ultrasound is a technology that is already in use in the food industry. Commercial systems could be adopted to reduce curing times for high quality products.

Collaborating Institution

UCD

Project Number: 5962

Funding Source: DAFM (08/R&D/D/683)

Date: May 2014

Project Dates: Jan 2005 – Dec 2008

How to Proceed

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UPDATE

The α-amylase and α-glucosidase Inhibitory Effects of Irish Seaweed Extracts

Key External Stakeholders

Diabetic patients, consumers, society, government authorities/legislators and the food industries.

Practical Implications for Stakeholders

Antidiabetic effects can be achieved through inhibiting the carbohydrate hydrolysing enzymes involved in digestion and absorption using α-amylase and α-glucosidase inhibitors. Seaweeds and their bioactive principles such as antioxidant and polyphenols also plays role in antidiabetic effects. This project led to identification of seaweed extracts useful for diabetic care.

Main Results

- The cold water and ethanol extracts of *Ascophyllum nodosum* had the strongest α-amylase inhibitory effect with IC50 values of 53.6 and 44.7 lg/ml respectively.
- Moreover, the extracts of *Fucus vesiculosus Linnaeus* were found to be potent inhibitors of α-glucosidase with IC50 values of 0.32 and 0.49 lg/ml.
- Out of 15 seaweeds, brown seaweed extracts (in particular *F. vesiculosus* and *P. canaliculata)* showed stronger efficacy to inhibit enzymes involved in intestinal carbohydrate digestion and assimilation.
- This study revealed that brown seaweed extracts may limit the release of simple sugars from the gut and thereby alleviate postprandial hyperglycaemia.

Opportunity/Benefit

Due to antioxidant and phenolic content, seaweed extracts showed antidiabetic effects. The present study reported the potential of algal extracts for use in functional food applications aimed at lowering glycaemic response. These extracts are natural sources of α-amylase and α-glucosidase inhibitors, and represent alternatives to drugs for diabetic care.

Collaborating Institutions

Teagasc Food Research Centre, Moorepark

University of Limerick

Teagasc Food Research Centre, Ashtown

Project number: MFFRI/07/01

Date: November, 2015

Funding source: Marine Institute and DAFM

Project Dates: 2007–2013

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UPDATE

Transfer of Antimicrobial Resistance from Lactic Acid Bacteria (LAB) to Other LAB and to Pathogenic Bacteria

Key Stakeholders

Dairy industry, scientists, regulatory personnel, EFSA

Practical Implications for Stakeholders

The emergence and spread of antibiotic resistance encoding genes among bacteria has lead to the development of multiple resistant strains (MDR). These represent a serious public health risk, especially to the immune compromised. This project examined whether commercial lactic acid bacteria (LAB) can transfer antibiotic resistance to other LAB strains or to pathogenic bacteria. The results highlight the importance of strain selection in food fermentations and provide data for a risk assessment of the role of LAB in the emergence of MDR pathogenic bacteria.

Main Results

Antibiotic resistance genes were readily transferred between different lactic acid bacteria (LAB) strains *in vitro*, in a plant model system and to a lesser extent in a rumen model. Transfer to *Listeria* spp. was also observed *in vitro* and in a food system but not to *Salmonella* spp., *S. aureus* or *E. coli*.

Opportunity/Benefit

Lactic acid bacteria (LAB) are a potential source of resistance determinants that may be disseminated between LAB and to pathogenic strains including *Listeria* spp. This research demonstrated transconjugation in the natural environment and suggests that food matrices such as fermented milk may provide a suitable environment to support gene exchange. Strain selection for fermented foods should also include an assessment of the potential for antibiotic resistance dissemination in a public health context.

Collaborating Institutions

University College Dublin

Project Number: 5272

Funding Source: EU FP6 CT-2003-506214

Date: June, 2012

Project Dates: Jan 2004 – Jun 2007

How to Proceed

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UPDATE

Understanding and Exploiting the Biogenesis of Cheese Flavour

Key External Stakeholders

Cheese producers, dairy industry, food manufacturers.

Practical Implications for Stakeholders

The project investigated mechanisms to control and accelerate Cheddar cheese flavour and the information generated within this project has significantly enhanced the understanding of flavour generation in Cheddar cheese which can also be applied to many other cheese varieties.

- This research has provided invaluable information on a range of factors that influence cheese quality and the rate of cheese ripening.
- Factors which impact on the activity of chymosin were elucidated.
- Mechanisms to enhance lipolysis in Cheddar cheese were identified.
- The performance of commercial accelerating ripening agents in Cheddar cheese were evaluated.

- Microfluidisation was identified as a practical method to create specific populations of attenuated lactic acid bacteria for use as adjuncts in cheese production.
- Microfluidisation was identified as a suitable method to create food grade liposomes which can be used to deliver exogenous enzymes in cheese curd, with minimum losses to the whey.
- Factors governing the encapsulation efficiency of enzymes and cell free extracts in liposomes were determined.

Main Results

This project investigated a range of factors that influence the ripening of Cheddar cheese. The major areas of focus were enhancing lipolysis and proteolysis through addition of exogenous enzymes, use of adjunct cultures and process manipulation of cheesemilk to control and accelerate cheese ripening.

Opportunity/Benefit

The capacity and expertise generated within this project is readily available and can be utilised for specific cheese applications by contacting the relevant researchers involved.

Collaborating Institutions

University College Cork; University of Limerick; Institute of Chemical Technology Prague; McGill University

Project Number: 5433

Funding Source: DAFF(04/R&D/C/238)

Date: March, 2011

Project Dates: Jan 2005 – Jun 2009

How to Proceed

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UPDATE

Understanding the Perception of Creaminess in Dairy Foods

Key External Stakeholders

Food and food ingredient manufacturers, dairy industry.

Practical Implications for Stakeholders

- High pressure processing was shown to enhance the creaminess of yogurts and produce low-fat yogurts as creamy, or *even creamier,* than their conventionally produced full-fat counterparts.
- A better understanding of the relationship between product structure and creaminess perception, based on composition and processing has been developed.

The results of this work have led to further funding from Enterprise Ireland under the Commercialisation Fund and Teagasc researchers are currently developing a new platform technology for manufacturing size controlled protein particles, specifically to be used as novel fat replacer

ingredients. Access to such an energy efficient and innovative food processing technology would benefit dairy and food ingredient companies greatly by allowing them to produce higher quality, low fat dairy-based products with enhanced nutrition at significantly lower production costs.

Main Results

- High pressure milk processing (microfluidisation) was shown to significantly improve the creaminess of low fat yogurts.
- The development of a new dynamic imaging technique for assessing product quality.
- A predictive model for creaminess based on composition, rheology and microstructure.
- Increased understanding of how microstructure can be controlled to enhance creaminess.
- Demonstration that fat release from food matrices can be controlled by pH and emulsifier type.

Opportunity/Benefit

There is an opportunity for dairy food ingredient manufacturers to partner with Teagasc to investigate the true potential of such high quality low fat dairy based ingredients using this novel approach through optimisation and validation for specific applications. Expressions of interest from relevant companies are welcome.

Collaborating Institutions

University College Cork

Project Number: 5606

Funding Source: DAFF (06/RD/TMFRC/431)

Date: July, 2011

Project Dates: Nov 2006 – Dec 2010

How to Proceed

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UPDATE

Updating Cheesemaking Efficiency

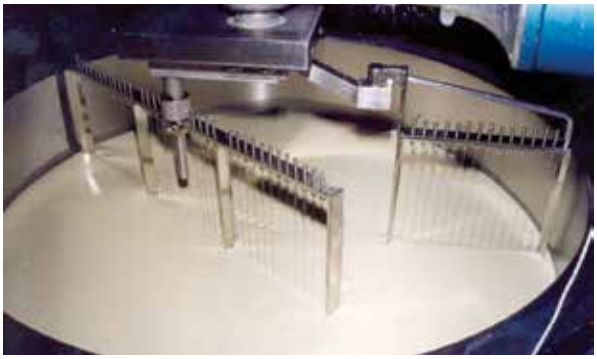
Key External Stakeholders

Irish Cheese and Dairy Industry.

Practical Implications for Stakeholders

Manufacturing efficiency is a key aspect of cheese manufacture which influences cheese composition, milk component recoveries and plant profitability.

A major outcome of this project is the provision of new information on the comparative effects of bovine chymosin and camel chymosin on Cheddar cheese making efficiency, and the effects of the high heat treatment of milk at different pHs on its rennet gelation and curd forming characteristics. It also provides an extensive compendium on the effects of milk quality and



cheese manufacturing conditions on cheese making efficiency and quality in the form of 2 monographs (Moorepark Monographs 1 and 2) published in 2010.

Main Results

- The use of chymosin of camel origin (*Camelus dromedarius*) or *Rhizormucor miehei* rennet in place of bovine chymosin (*Bos taurus*) as coagulant in the experimental manufacture of Cheddar cheese had significant effects on the recovery of fat from milk to cheese, cheese yield, and age-related changes in primary proteolysis and texture. These effects depended on the level of coagulant (number of milk clotting activity units added) and firmness of the milk gel at cutting.
- The effects of increasing pH from 6.6 to 7.5 during high heat treatment of milk (80 °C for 5 min) resulted in depletion in the content of k-casein on the casein micelle and an increase in the level in the milk serum to an extent depending on pH. Desk-top cheesemaking studies indicated that increasing the milk pH during heating accentuated the adverse effects of high heat treatment on the rennet coagulability of the milk at pH 6.55 and its cheesemaking characteristics.
- Two monographs (Moorepark Monograph 1. Cheese manufacture: Quality Characteristics of the milk; Moorepark Monograph 2. Cheese Manufacture: Control and prediction of quality characteristics), on the effects of milk quality and cheese, manufacturing conditions on cheese making efficiency and quality were prepared and distributed to Irish Dairy industry in 2010.

Opportunity/Benefit

The research makes available to the dairy industry a database of information on the effects of key cheesemaking parameters on manufacturing efficiency and cheese quality. The comparative study on different coagulants provides statistically validated, practically-applicable information on the impacts of the bovine chymosin, camel chymosin and *Rhizormucor miehei* coagulants on cheesemaking efficiency and changes in the proteolysis and texture of Cheddar cheese during maturation. The cheese manufacture monographs provide a user-friendly reference source of practical information directly applicable to optimisation of cheese manufacturing efficiency and quality.

Collaborating Institutions

N/A

Project Number: 5979

Funding Source: Dairy Levy

Date: November, 2012

Project Dates: Jan 2010–Dec 2011

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UPDATE

Water Activity Control and Texture Stabilisation of High Protein Snack Bars

Key External Shareholders

Dairy ingredient manufacturers, nutritional food formulators.

Practical Implications for Stakeholders

- The relative susceptibility of milk protein ingredients to textural change (hardening) in high protein (35%) bar formulations over time was established under standardised conditions. Hardening in mixed protein bars resulted in a broadly linear response to ratio inclusion. However, caution is required in the application of this information because of specific variation in bar formulations.
- Different windows of concentrations were observed for individual protein ingredients depending on formulation that could be related to molecular jamming and subsequent hardening.
- Minimising water activity differences between liquid and solid components provides a means of controlling or delaying textural change.

Advanced analytical techniques developed during the course of this project may be used to support further development: FT-IR measurements show whether water or solvent-induced plasticisation of protein powders in bar matrices is sufficient for protein-ingredient interactions to occur at a molecular level. Confocal scanning laser microscopy (CSLM) techniques allow good quality imaging of physical changes in protein bars during storage.

Main Results

- Hardening of protein bars varied with protein type e.g. decreased hardening occurred in whey protein-based bars compared to casein-based systems.
- Textural change in high-protein bars is related the hydration behaviour of individual components and the competition for available moisture.
- Powder packing behavior was also influenced by protein type. Rheological-based frequency dependent measurement of liquid-solid transitions link particle interactions to time-dependent ageing (hardening) phenomena.

Opportunity/Benefit

The resulting database of information allows a better choice of ingredients to be made in order to ensure improved shelf-life. Such knowledge may be utilised by technical support teams of dairy ingredient companies engaged in ingredient marketing to protein bar formulators

Collaborating Institutions

University College Cork

Project number: 5951

Funding source: FIRM/DAFM (08/R&D/TMFRC/651)

Date: May, 2015

Project Dates: April 2009 – Mar 2013

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UPDATE

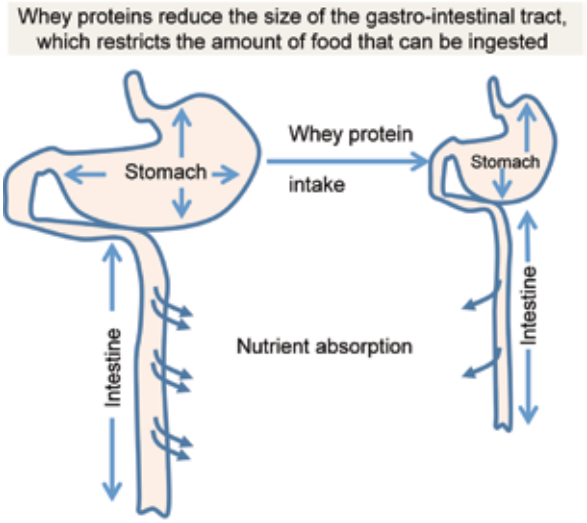
Whey Protein Isolate Reduces the Size of the Gastro-Intestinal Tract and in Turn Weight Gain; a Renewed Focus to Create Anti-Obesity Whey Protein Enriched Food Products

Key External Stakeholders

Dairy industry, policymakers and food manufactures.

Practical Implications for Stakeholders

Creation of whey protein isolate-enriched food ingredients or ready-made food products with anti-obesity properties



Main Results

- Whey proteins reduced weight gain compared to casein intake.
- Whey proteins reduced the size of the gastro-intestinal tract, which appeared to restrict the amount of food that can be ingested to support weight gain.

Opportunity/Benefit

We have established an *in vivo* model that can be used to test the efficacy of whey proteins to counteract the obesogenic effects of wide variety of commercially available food products.

The data provide the basis to create whey protein enriched food ingredients or ready-made food products that can reduce weight gain.

Collaborating Institutions

University College Cork (Ireland), University College Dublin (Ireland), University of Helsinki (Finland) and Chinese Academy of Science (China).

External Collaborators

Professor John F. Cryan (University College Cork), Professor John R. Speakman (Chinese Academy of Sciences, Beijing, China), Professor Helen Roche (University College Dublin) and Professor Riitta Korpela (University of Helsinki, Finland).

Project number: 5974

Date: April 2015

Funding source: Teagasc

Project dates: May 2009-September 2014

How to Proceed

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UPDATE

WPI Impedes Weight Gain by Reducing the Size of the Stomach and Intestine

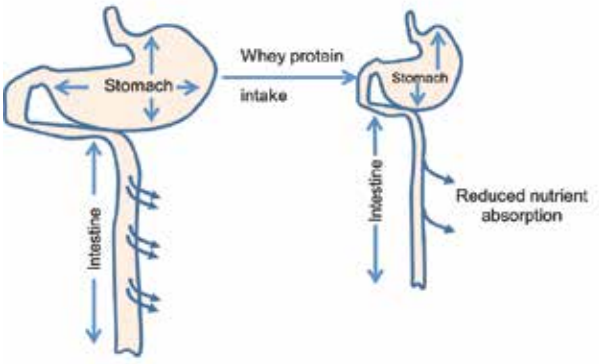
Key External Stakeholders

Dairy industry; ingredients companies; regulatory agencies; nutritionists; athletes; general public.

Practical Implications for Stakeholders

According to the World Health Organisation, nearly all Irish adults will be over-weight by year 2030. Thus, there is an urgent need to develop interventions that prevent the development of obesity.

Because whey is a by-product of cheese manufacture, there is a considerable economic benefit to using whey constituents as health promoting food products. Notably, whey protein isolate (WPI) has been shown to impede weight gain by reducing the size of the stomach and intestine. These findings provide the scientific backing for creation of whey protein enriched food ingredients or ready-made food products with anti-obesity effects.



Main Results

- Animals fed WPI show reduced weight gain compared to those fed casein.
- WPI reduced the size of the gastro-intestinal tract, which appeared to restrict the amount of food that can be ingested to support weight gain.

Opportunity/Benefit

Much attention has focused on identifying the bioactivity associated with milk proteins that reduce weigh gain by causing satiety (reduction in meal number) and satiation (reduction in meal size). We have identified a new mechanism by which WPI impedes weight gain involving the stomach and intestine. Thus, the dairy and Functional Food Industry will now be able to focus attention on WPI and develop protein enriched food ingredients or ready-made food products with anti-obesity effects. The efficacy of such products can be tested by undertaking animal feeding trials in Teagasc, which will help to further establish health claims, and commercialise the related products.

Collaborating Institutions

UCC, UCD, University of Helsinki (Finland), Chinese Academy of Sciences (Beijing, China).

Project Number: RMIS5974

Funding Source: Teagasc

Date: 30/04/2015

Project Dates: 01/05/2009-31/09/2014

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UPDATE

Bovine Serum Albumin is a Novel Anti-Obesity Dietary Protein

Key External Stakeholders

Dairy and meat industry, policymakers and food manufacturers.

Practical Implications for Stakeholders

The creation of food ingredients or ready-made food products with anti-obesity bioactivity in bovine serum albumin.

Main Results

Bovine serum albumin reduced body weight and fat mass and increased lean mass compared to casein intake.

Opportunity/Benefit

We have established for the first time that bovine serum albumin (BSA), a dietary whey protein, has anti-obesity effects.

The data provide the basis to use these proteins as functional food ingredients for humans and animals (e.g. pet industry to reduce unhealthy weight gain in domestic pets). Moreover, the data opens the opportunity to screen for the protein-derived bioactivity, which we anticipate will be more efficacious than the intact protein.

Collaborating Institutions

University College Cork (Ireland), University of Helsinki (Finland) and Chinese Academy of Science (China).

Project Number: 6103

Funding Source: Teagasc

Date: Jun 2016

Project Dates: Oct 2011 – Dec 2015

How to Proceed

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UPDATE

The Control of *Campylobacter* in Irish Poultry

Key External Stakeholders

Poultry farmers, Poultry processors, FSAI, DAFM, Retailers, Safefood, Consumers.

Practical Implications for Stakeholders

The main outcomes of this research are data that's supports the argument that all birds harvested post first-thinning should be subject to Campylobacter mitigation activities and a combination technology that has the potential to kill between 10,000 and 100,000 *Campylobacter* per cm^2 on chicken carcasses.

Main Results

- Thinning introduces *Campylobacter* into broiler flocks; caecal counts in birds at second thinning are similar, regardless of flock status at first thinning and reducing the time between first and second thinning to a maximum of 4 days is not an effective control strategy. All post-first thinning birds should be considered to be high risk and subject to logistic slaughter and possibly carcass freezing.
- The sequential treatment of trisodium phosphate and capric acid in conjunction with ultrasonication at 80 kHz will kill 10,000 *Campylobacter* per cm^2 on chicken carcasses.

Opportunity/Benefit

Processors could improve the safety of poultry and poultry products by subjecting all post first thinning broiler carcasses to crust freezing.

U|sing a combination of ultrasonication and chemical treatments, processors could significantly reduce Campylobacter on broiler carcasses. Although these are not currently permitted under EC legislation, the situation is under review and the data generated in this project should help inform a positive outcome.

Collaborating Institutions

University College Dublin

Project Number: 6123

Funding Source: Teagasc

Date: Jan 2016

Project Dates: Jun 2011 – Oct 2014

How to Proceed

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UPDATE

Campylobacter Control in Irish Broilers

Key External Stakeholders

Poultry farmers, poultry processors, DAFM, FSAI and poultry consumers.

Practical Implications for Stakeholders

The main outcome from this research is an innovation in biosecurity, the 'biosecurity cube' that will protect broilers from a range of avian diseases including infection with *Campylobacter*. The key recommendations, based on our updated understanding of the pattern of Campylobacter infection in broilers, are:

- Before restocking, all *Campylobacter* (carry-over from the previous flock) must be effectively eliminated from the house and surrounding environment. Feeder and drinker equipment disinfection present a particular challenge in this regard. A cleaning and disinfection SOP for this equipment has been developed by this project.

- The application of the 'biosecurity cube' concept to the entirety of the broiler house would significantly improve food safety, animal welfare and productivity.
- If commercially feasible, thinning should cease. If this is not feasible then stringent biosecurity & hygiene must be applied.

Main Results

This research mapped the sources and spread of *Campylobacter* on Irish broiler farms. It developed and delivered a 'biosecurity cube' that protected the birds from *Campylobacter* while at the same time improving their feed conversion efficiency and general welfare. Our work also demonstrated the rapid growth of these organisms in poultry, developed a standard operating procedure (SOP) for cleaning and disinfection of farms after harvest and validated current poultry litter composting to ensure these processes do not contribute to the spread of infection.

Opportunity/Benefit

This project was undertaken with the full cooperation of the poultry sector, farmers and processors. The information and technologies developed will greatly reduce the risk of future broiler flocks being infected with *Campylobacter*.

Collaborating Institutions

University College Dublin and the Food Safety Authority of Ireland (FSAI).

Project Number: 6418

Funding Source: DAFM (FIRM)

Date: March 2016

Project Dates: Feb 2013 - Jan 2016

How to Proceed

For further information access the full Technology Update at:
www.teagasc.ie/publications

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UPDATE

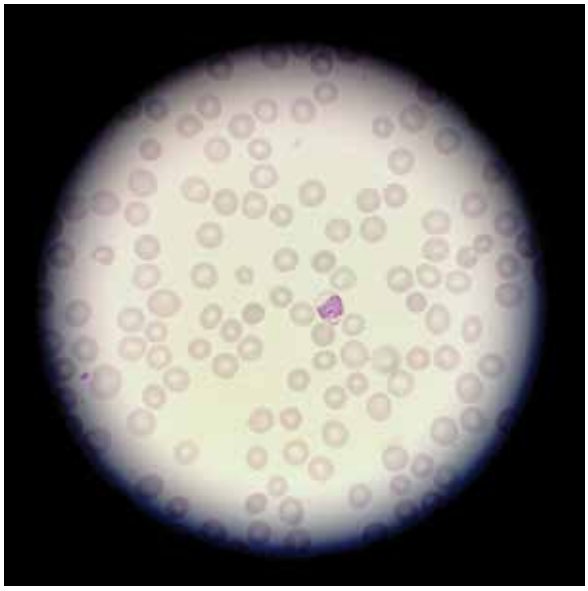
BLASTOHIT

Key External Stakeholders

Researchers, public health personnel.

Practical Implications for Stakeholders

Blastocystis is one of the most common human parasites in the world and has a global distribution. This work has resulted in the development of a novel primer set and PCR assay that will facilitate the surveillance of *Blastocystis* in humans and potential transmission sources. Further research may lead to novel beneficial ways to treat symptomatic infection by *Blastocystis*.



Main Results

Using a combination of PCR and sequenced based analysis we have investigated the prevalence and genetic diversity of *Blastocystis* in a number of human groups of interest including healthy adults, healthy infants, and family units. We have shown that *Blastocystis* is highly prevalent in the healthy Irish adult population but is not a common feature of the healthy infant gut. We have also developed a novel primer set and PCR assay that will facilitate epidemiological surveys of *Blastocystis* in human and animal groups. This novel primer set has shown that mixed infections of *Blastocystis* are much more common than previously thought which may be relevant to disease groups. We are currently analyzing data to look at the link between *Blastocystis* and specific bacterial groups in the gut.

Opportunity/Benefit

As a consequence of our studies, we have a new understanding of the prevalence of *Blastocystis* (a speculated emerging pathogen) in the Irish population. The development of a novel primer set allows the surveillance of this microorganism both in human cohorts and also potential sources of transmission to humans e.g. livestock, water, other humans groups etc. Moreover, any link between the presence/absence of *Blastocystis* and specific bacterial groups may result in novel beneficial ways to treat symptomatic infection by *Blastocystis*.

Collaborating Institutions

UCC, APC, Wageningen University, University of Colorado. Statens Serum Institut, Copenhagen

Project Number: 6477

Funding Source: Marie Curie Actions, EU

Date: Dec 2015

Project Dates: Sept 2013 - Dec 2015

How to Proceed

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UPDATE

Design and Development of Realistic Food Models with Well-Characterised Micro- and Macro-Structure and Composition (DREAM)

Key External Stakeholders

Cheese and Dairy Industry

Practical Implications for Stakeholders

The outcomes of this work include:

- A procedure for the preparation of a semi-hard rennet-curd model cheese in which composition is precisely controlled and which can be used to validate the growth/survival of microorganisms under different conditions.
- A database on the effects of varying salt concentration and pH in model cheese on the survival of probiotic bacterial strains and on the chemical and rheological properties.

- A database on the survival of probiotic bacterial strains in full-salt and reduced-salt cheddar cheeses during maturation.

Main Results

- A model cheese-making system was designed for the manufacture of semi-hard rennet-curd cheese in which salt (1.2, 2.2 or 3.5%) and pH (4.8, 5.3 or 5.8) could be systematically controlled.
- The survival of probiotic bacteria *Bifidobacteria* (BB12), incorporated into the model cheese at a level of ~108cfu/g, was independent of variations in NaCl and pH at ripening times up to 96days. However, after 150days storage, the mean count of BB12 had decreased significantly in the high-salt (3.5%) high-pH (5.8) cheese but not in the other cheeses.
- The survival of probiotoc strain *Lactobacillus casei* (LC-01), incorporated at ~108 cfu/g, was independent of pH variation in the high salt cheese (3.5%) at ripening times up to 47days but decreased significantly in the low pH cheese (pH 4.8) after longer ripening times (96-150days). However, the survival of LC-O1 was not affected by pH in the cheese with lower salt levels (1.2 and 2.2%).
- A study on the survival of these probiotic strains (BB12 and LC-01) in cheddar cheese showed that both strains grew in the cheese during ripening, and were unaffected by salt content of the cheese.

Opportunity/Benefit

The research makes available to the dairy industry a database on the effects of salt and pH on the survival of two probiotic bacterial strains in a semi-hard model cheese (47% dry matter) and cheddar cheese in addition to information on the chemical, rheological and viscoelastic properties of model cheese.

Collaborating Institutions

INRA; ADRI Development; Campden BRI; Consiglio Nazionale delle Ricerche, Instituto di Scienze delle Produzioni; Actalia- Produits Laitiers; KOKI, Központi Élelmiszer-tudományi Kutatóintézet; INRA Transfert; Campden, BRI;CNRS, Centre National de la Recherché Scientifique; IRTA, Institut de Recerca I Tecnologia Agroalimentàries Alimentari; IFR, Institute of Food Research; TI Food and Nutrition, Stitching Top Institute Food and Nutrition; United Biscuits (UK) Limited; VTT, Valtion Teknillinen Tutkimuskeskus; Soredab, Soredab SAS; University of Ljubljana; Wageningen University.

Project Number: 5983

Funding Source: EU FP7

Date: Nov 2014

Project Dates: Jun 2009 - May 2013

How to Proceed

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EXPERTISE

Innovative Dairy Flavours

Researchers based at Teagasc Food Research Centre, Moorepark have developed a strong scientific base on the understanding of dairy flavour pathways, particularly in relation to cheese, cheese concentrates, butter and yogurt which is now available for exploitation by companies. We can provide specialist know-how and analytical services in formulating and processing natural cheeses in combination with other ingredients in order to develop a range of dairy flavour ingredients to suit particular food applications in the convenience and snack-food industry.

Background

Less personal time for food preparation has led to an increase in the consumption of prepared and semi-prepared convenience foods. Food manufacturers have to target these developments to ensure competitiveness. Dairy ingredients are an important component in many foods, used to provide flavour, functional and/or visual attributes. At Teagasc a strong scientific base has been developed on the understanding of dairy flavour pathways, particularly in relation to cheese, cheese concentrates, butter and yogurt, through years of research and commercial interaction.

Benefits to Industry

Engagement with Teagasc by food companies provides

- Access to expertise, state-of the-art infrastructure and specific technological services.
- Assistance in development of new dairy flavour ingredients.

Areas of Expertise

- Development and use of concentrated dairy and cheese flavours, and enzyme-modified cheeses.
- Selection of commercial food grade enzymes through database of key enzyme activities.
- Biotechnological approaches to flavour development.
- Selection of bacterial cultures for flavour development.
- Identification of off-flavours e.g. lipolytic & oxidative rancidity.
- Use of micro-encapsulation for flavour protection.
- Advanced microbiological, biochemical and analytical capabilities.

Facilities/Equipment

- Pilot plant facilities including mixers and tall-form spray drier.
- Separation, concentration, homogenisation and heating systems.

- Analytical capability including advanced chromatographic techniques, GC-MS, GC-O, GC-FID, GC-PFPD, HPLC.

Range of Solutions

There are several routes by which companies can engage with Teagasc, from provision of technological services, to consultancy, contract or collaborative research.

Of Interest to

- Food ingredient companies involved in development of dairy flavoured ingredients.
- Food manufacturers using dairy flavours in preparation of convenience and snack-foods.

How to Proceed

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EXPERTISE

Bio-functional Food Engineering (BFE) Facility

The Bio-functional Food Engineering facility (BFE) is a state-of-the-art facility for food technologists to process and stabilise ingredients for use in nutritional beverages including infant formula. It provides key research infrastructure to support the Teagasc Food Research Programme and collaborations with industry and is a centre of excellence for nutritional beverage research, including infant formula.

Background

The BFE facility, funded through the FIRM Strategic Equipment Fund 2006, is a state-of-the-art facility for food technologists to process and stabilise ingredients for use in nutritional beverages, including infant formula. Designed to fast track the transfer of ideas from the laboratory to pilot plant, the range of unit operations offered by BFE cover areas such as dehydration, separation, encapsulation and thermal processing.

Benefits to Industry

The BFE facility provides a 'one stop facility' for dairy based beverage applications. It has unique fully integrated research pilot scale fermenters/reactors and processing capabilities with easy access to scale-up equipment at Moorepark Technology Ltd. (MTL). The equipment has been carefully matched to allow transfer of product from one bench scale process to the next, providing a highly flexible processing environment where the goal is high throughput of experiments with complex design.

The BFE provides a technological platform for use by industry at the near market stage. Ultimately, it is expected that the facility will make a key contribution to the development of foods and beverages containing bio-active ingredients with proven stability and shelf-life.

Facilities/Equipment

- Multi-stage spray dryer with fluidising capabilities capable of drying milk derived components.
- Multifunctional membrane filtration plant suitable for separating milk and ingredients.
- Supercritical fluid extraction.
- Adsorber chromatography unit.
- Continuous decanter centrifuge for concentration and purification of bioactive substances post-fermentation, precipitation and hydrolysis of dairy and plant materials.
- Concentric nozzle encapsulator for micro-encapsulation of bio-active components 10- 1000µm.
- Microthermics heat exchanger & in-line homogeniser.

Of interest to

- Dairy and Food Industry.
- Ingredient and Infant Formula Manufacturers.

How to Proceed

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EXPERTISE

Consumer Behaviour and Food Marketing

Improving strategic marketing performance of the Irish agri-food sector is the main objective of the Consumer and Market Insights Research team at Teagasc Food Research Centre, Ashtown. We carry out both consumer and market research on many food related topics and use qualitative and quantitative research techniques. The team provide advice on consumer behaviour, innovation management, new product development, market development and food policy.

Background

Through internally and externally funded research Teagasc researchers have developed significant expertise in the area of consumer behaviour and food marketing. Numerous collaborations with third level institutions and companies have produced many successful research outputs, and we continue to encourage such links and to work with companies to assist in new product development through market insights and understanding the target consumer.

Benefits to Clients

Knowledge and insights regarding consumers' wants, needs and perceptions are essential for focusing innovation efforts developing and marketing new products. The market insights covers innovation management, strategic market planning, marketing channels, and supply chain and relationship management.

Areas of Expertise

- Consumer-led new product development.
- Segmentation and consumer profiling.
- Insights into consumers e.g. behaviour and attitudes.
- Risk perception and communication.
- Market analysis and planning.

Facilities/Equipment

- Quantitative research.
  - Consumer surveys
  - Product testing
- Qualitative research.
  - Individual depth interviews
  - Mini-group discussions
  - Telephone depth interviews
  - Focus groups
- Executive interviews.

Range of Solutions

Depending on the nature of work requested and the inputs from each party, contract research or collaborations can be considered. This can range from surveys to smaller focused studies to market trends and reviews.

Of Interest to

Expertise and services will be of interest to

- Food manufacturers.
- Food retailers.
- Business start-ups.
- Public agencies and policy makers.
- Researchers interested in commercialising their research.

How to Proceed

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EXPERTISE

Meat Technologies

Teagasc, through its food research centre at Ashtown, supports innovation in the Irish meat industry through the delivery of high quality research and industry development programmes. Areas of expertise include meat quality and safety, process technologies as well as the development of healthier and more functional added value meat products. Facilities include a research abattoir, cooked meats facility, sensory unit and state-of-the-art research laboratories.

Background

Research projects funded especially through DAFF, but also Enterprise Ireland and industry have strengthened the meat research expertise and facilities at Teagasc. State-of-the-art facilities include a pilot scale meat unit incorporating a licensed abattoir, production units for meat processing and packaging under controlled refrigeration systems and a cooked meat facility for curing, smoking and cooking.

Benefits to Industry

Teagasc supports competitiveness and sustainability in the meat sector through excellence in science, technology and management systems. Advice in areas such as packaging/labelling, legislation and food assurance standards, ingredients and equipment sourcing can be provided through consultancy. Various testing services are offered on a fee-paying basis as well as access to training and skills development programmes and facilities.

Areas of Expertise

- Enhancement of meat quality.
- Evaluation of meat quality.
- Development of healthier functional products and value added processed meat products.
- Exploitation of meat by-products and waste streams.

Facilities/Equipment

- Slaughtering/boning.
- Meat processing and cooking.
- Packaging.
- Chilling and freezing.
- Analytical (incl. GC, GC-MS, HPLC, NMR).
- Sensory testing facilities.
- Product development plant/incubation units.

Testing services

- Shelf-life and microbial testing.
- Residue and chemical analysis.
- Compositional and nutritional analysis.
- Consumer and sensory studies.
- Quality testing including flavour, colour and textural analysis.

Range of Solutions

Companies have the opportunity to pay for consultancy services, product development support, access to facilities, training programmes on an individual and confidential basis. Also, routine and speciality meat testing services are available. Collaborations in meat research with academic and industrial partners are also actively undertaken.

Of Interest to

- Meat processors and manufacturers.
- Consumer food manufacturers incorporating meat into their products.
- Research institutes/universities seeking collaborators.

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EXPERTISE

Seafood Technology

Teagasc, through it's food research centre at Ashtown, supports innovation in the seafood sector through delivery of high quality, commercially-relevant research. Researchers and technologists have wide-ranging expertise and work closely with industry to develop innovative concepts with unique selling points and world-leading technologies.

Background

As an island country, off the mainland of Europe, Ireland has a vast marine biodiversity that can be exploited in a variety of ways. Over twenty years of seafood research funded by DAFF, Enterprise Ireland, Bord Iascaigh Mhara (BIM), EU funding and private industry has provided world-class knowledge in the areas of packaging, ingredients and processing technologies. Teagasc works closely with BIM to ensure that Irish seafood SME's have access to emerging technologies and assistance in applying them within their businesses. The Marine Functional Food Research Initiative, led by Teagasc Ashtown, is focused on the identification of novel marine food ingredients and products which will allow for diversification into new markets. Teagasc is currently investigating the use of fish processing waste, the sustainable exploitation of underutilised species of fish and seaweed, and the development of value-added products from finfish and shellfish.

Benefits to Industry

Research staff and technologists at Teagasc, Ashtown recognise that viable seafood concepts are underpinned by strong science and an understanding of the interactions between the product, process and packaging. The wide ranging expertise and interdisciplinary team approach ensures solutions can be developed to maximise product quality and eating experience. Teagasc works closely with industry and has established linkages with international experts in the field of seafood R&D including NOFIMA, CSIC, SEAFISH-UK and other world-class institutions. Industry-relevant workshops ensure companies are kept up to date with relevant packaging, labelling, food safety and processing developments and Teagasc scientists ensure that knowledge is transferred from research to industry via close interactions with BIM and seafood sector businesses.

Areas of Expertise

- Processing technologies.
- Packaging technologies.
- Temperature mapping.
- Effect of processing on eating quality and nutrition.
- Interaction of multi-component ready meal solutions.
- By-product utilisation and nutraceutical development.

Facilities/Equipment

- Seafood processing and cooking equipment.
- Packaging equipment.
- Chilling, freezing and freeze-drying facilities.
- Analytical equipment (GC, GC-MS, HPLC, NMR).
- Sensory testing facilities.
- Product development plant/incubation unit.

Range of Solutions

Teagasc provides a range of services to seafood companies and undertakes collaborative/contract research incorporating new product development, pilot scale trials, packaging solutions, ingredient sourcing, consumer research and testing (microbial, quality, sensory, residue etc.).

Of Interest to

- Seafood processors and related companies.
- Seafood ready-meal manufacturers.
- Food industry companies wishing to incorporate marine ingredients.

How to Proceed

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Technology

EXPERTISE

Cereal and Bakery Technologies

Teagasc researchers can provide specialist know-how, facilities and services in cereal science and bakery technology. This includes, but is not limited to, product formulation, innovation and sample testing. Researchers at Teagasc are available to provide consultancy or carry out contract/collaborative research for companies in the aforementioned areas with a view to exploitation of novel products/processes in bread and baked goods markets. A range of testing services is also offered from shelf life to microbial to residue analysis.

Background

Through internally and externally funded research Teagasc researchers have developed significant expertise in the area of baked goods and cereals technology. Numerous collaborations with third level institutions and companies have produced many successful research outputs, and we continue to encourage such links and to work with companies to assist in product innovation, new product development and service provision.

Benefits to Industry

The expertise and facilities, primarily at Teagasc Food Research Centre in Ashtown allows millers, bakers and food companies access to state-of-the-art facilities and specialist knowledge, as well as offering a range of specialist and routine services.

Areas of Expertise

- Wheat flour chemistry and rheology.
- Gluten-free formulations.
- Low glycaemic breads.
- Beta-glucan enriched breads.
- Health/functional snacks.

Facilities/Equipment

- Mill Room.
- Test bakery.
- Dough rheology laboratory.
- Access to National Imaging Centre.
- Sensory testing facility.
- Product development plant/incubation units.

Range of Solutions

Depending on the nature of work requested and the inputs from each party, contract research or collaborations can be considered. This could range from new product development, to pilot scale trials. Ingredient sourcing, consumer research and testing services (shelflife, microbial, quality testing, residue analysis etc.) are other options available.

Of Interest to

- Millers, bakers and those in the snack food industry who incorporate cereal and flours into their products.
- Niche baked goods manufacturers.
- Health food specialists in breads/confectionary/baked goods market.

How to Proceed

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Technology

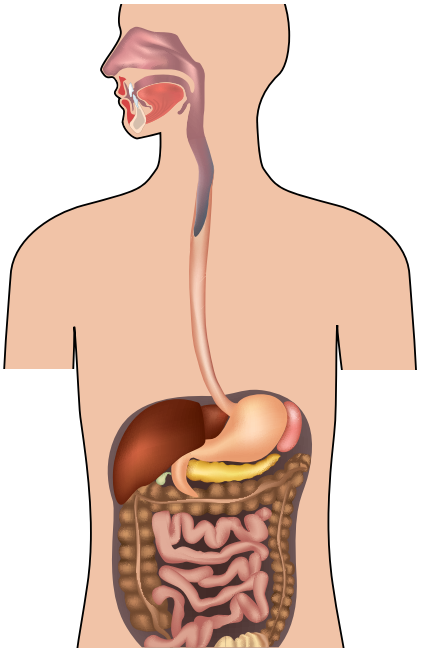
EXPERTISE

Digestion, Bioaccessibility and Bioavailability

Researchers at Teagasc Food Research Centre are available to perform contract or collaborative research with companies to map the fate of food during gastro-intestinal digestion. Expertise is available in digestion, bioaccessibility and bioavailability of food components using *in vitro* and *in vivo* animal models.

Background

With the development of foods for health, there is a need to understand how food and its components are digested. Teagasc has developed a platform to digest food and assess if /when individual components are bioaccessible and bioavailable to the body.



Benefits to Industry

Teagasc can assist clients in tracking food and its components during gastro-intestinal (GI) digestion. Such knowledge can be used to modify food processing, food formulation and food design to improve efficacy of bioactives and nutrients. Digested samples at various time points can be provided for further screening in bio-assays. Information can also be used as a pre-cursor or selection aid for larger, more costly human intervention studies.

Areas of Expertise

- Facilities/Equipment.
- Range of solutions.

Teagasc has the capability to map the fate of food and its components during GI digestion. This can be achieved by providing information on digested food or food ingredients or by providing digested, freeze-dried samples for further testing.

Of interest to

Functional food/ingredient manufacturers

How to Proceed

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EXPERTISE

Starter Culture Technology

Teagasc researchers can provide specialist know-how, facilities and services in starter culture selection and improvement. State-of-the-art developments in genomics and metabolomics are providing the tools for a more 'knowledge-based' approach to selection of desirable cultures. By linking genomic traits to phenotypic outputs, it is now possible to mine the metabolic diversity of starter cultures and select strains with desirable and industrially significant properties which can impact on both the production and final quality of the product.

Background

Fermented dairy products are one of the key drivers of exports by the dairy industry. The starter cultures used for production of these products are of great industrial significance. However the drive for new products to meet consumer demands can push the boundaries of microbial performance, requiring the development of new starter culture blends with novel properties. Teagasc has developed valuable capabilities in starter selection and improvement, employing state-of-the-art genomic technologies in a more 'knowledge-based' approach to the selection and generation of desirable cultures.

Benefits to Industry

An in-depth knowledge of properties such as phage resistance, flavour and texture can allow starter blends to be 'tailor made' to suit industry needs. This approach also allows for the potential improvement of these and other key characteristics in existing strains, strains which are at the core of the dairy industry. Applying this knowledge to starter culture development is enabling the generation of superior starters and novel products for future market expansion.

Areas of Expertise

- Screening and selection of novel cultures.
- Starter blend deconstruction and characterisation.
- Development of starter rotation schemes.
- Food-grade approaches to starter culture improvement.
- Genomic and metabolic profiling of dairy cultures.
- Phage audits of dairy processing facilities.
- Development of phage detection systems.

Facilities/Equipment

- Specialised equipment for monitoring key technological traits, e.g. iCinac (AMS Alliance)
- Genome sequencing capabilities.
- Dedicated flavour chemistry laboratory.
- Extensive analytical facilities (e.g. HPLC, GC-MS)

Range of solutions

There are several possibilities by which companies can engage with Teagasc, from provision of services, to contract or collaborative research.

Of interest to

- Commercial dairy companies.
- Commercial starter culture suppliers

How to Proceed

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EXPERTISE

Bioactive Research

Teagasc researchers can provide specialist know-how, facilities and services in bioactive discovery, validation and characterisation. Expertise available includes the discovery of bioactive fractions from a myriad of food sources including milk, meat, fish, cereals, plants and food waste streams. Researchers at the Teagasc Food Research Centre are available to carry out contract or collaborative research with companies to identify bioactive compounds and functional food agents, to assess their bioactivities *in vitro* and *in vivo*, to characterise mechanisms of action, to scale-up production and include in carrier foods.

Background

Teagasc has significant expertise and infrastructure in the area of bioactive and functional foods research. Numerous collaborations with third level institutions and companies have led to many successful research outputs. We work with companies to assist in product innovation, new product development and service provision.

Benefits to Industry

Teagasc Food Research Centre allows food companies to access state-of the-art facilities and expertise to screen for bioactive fractions, to validate efficacy *in vitro* and *in vivo*, to identify bioactive compounds, to investigate survival during gut transit, to validate in animal models, to understand mechanism of action, to scale up production, to include in carrier foods, to investigate sensory aspects and to determine shelf-life.

Areas of Expertise

- Proteins, peptides, carbohydrates, lipids, micronutrients, polyphenols.
- Bioassays (high to low throughput) that target heart health, obesity, diabetes, muscle health and satiety. Bioassays are also available to determine probiotic, prebiotic, anti-bacterial, immunomodulatory, anti-oxidant and anti-proliferative activities.
- Bioactive generation and fractionation.
- Bioactive bioavailability.
- Scale-up & formulation.

Facilities/Equipment

- HPLC, H-NMR, FPLC, GC, GC-MS, Flash chromatography, TLC, MALDI-TOF, ESI-MS/MS, amino acid analyser, peptide synthesizer.
- State-of-the-art tissue culture facility.
- Pilot plant.

- Mice and pig research facilities.
- Sensory testing.

Range of solutions

There are several possibilities by which companies can engage with Teagasc, from provision of services, to contract or collaborative research.

Of interest to

- Food and Beverage Manufacturers.
- Food SMEs.
- Ingredient and Infant Formula Manufacturers

How to Proceed

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EXPERTISE

CheeseBoard 2015

Teagasc is harnessing the resources of all institutions engaged in cheese research in this all-Ireland collaborative initiative in order to create a critical mass of expertise with which to address priority issues set out by Irish cheese manufacturers. The multidisciplinary approach embraces consumer interaction and lifestyle changes, technological innovation, new investigative tools at molecular level, specialist analytical capabilities and a nutritional study investigating the health benefits of a 12-week diet containing Vitamin D-fortified, reduced-fat Cheddar cheese. Researchers at Teagasc Food Research Centre, Moorepark and associated CheeseBoard 2015 partners are available to carry out contract or collaborative research with companies in the aforementioned areas. A range of testing services and consultancy is also offered.

Background

'CheeseBoard 2015' was adopted as the masthead for a Teagasc-led cheese research proposal in collaboration with University College Cork (UCC), University of Limerick (UL), University College Dublin (UCD) and Agri-Food and Biosciences Institute, Northern Ireland (AFBI) that was successfully submitted to a FIRM 2010 Call launched by the Department of Agriculture, Food & Marine. The research call came on foot of the major food policy document –'Food Harvest 2020' which forecasts a substantial expansion in Irish cheese production based on increased milk production following the lifting of EU Milk Quota restrictions in 2015.

Benefits to Industry

CheeseBoard 2015 addresses through research a number of key questions impacting on industry e.g. to adapt cheese manufacturing processes to reduce fat and salt without compromising cheese quality; to assess the health benefits of vitamin D fortified, reduced fat cheddar cheese, to use next generation sequencing to study cheese microbiota and the bacteria that cause defects, and to rapidly detect trans fatty acids.

Areas of Expertise

- Cheese for health (Teagasc)
- Cheese science & technology (Teagasc)
- Cheese diversification strategies (Teagasc)
- Consumer & market studies (Teagasc)
- Cheese culture – comparative genomic analysis (UCC)
- Cheese culture enzymology (UL)
- Microbiota of cheese defects (Teagasc)

Facilities/Equipment

- Cheese making equipment.
- Flavour Chemistry laboratory (Teagasc Moorepark)
- Flow cytometry (University of Limerick)
- Spectroscopic analyses and chemometrics (Teagasc Ashtown)

Range of solutions

Companies can engage via Teagasc and other

CheeseBoard 2015 partners to avail of services.

Of interest to

- Cheese manufacturers.
- Food Ingredient applications developers

How to Proceed

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Teagasc
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Technology

EXPERTISE

Food BioTest Capabilities

The prevalence of major diseases such as obesity, diabetes, sacropenia and cardiovascular disease is increasing in the human population. Therefore, a major focus in the Functional Food sector is to develop food ingredients that improve health and reduce the incidence of disease. It is important to assess the functionality of the ingredients of interest by undertaking animal feeding trials representative of human consumption. Teagasc is in a position to assist companies in this process through its state-of-the-art Food Bio-test facility.

Background

As part of Teagasc's on-going commitment to improving the health of people in Ireland, a Food Bio-test facility was established to test the efficacy of food ingredients (bioactives, nutrients, probiotics, oligosaccharides and prebiotics) in pig and/or mice. With the help of state of the art technology, we are able to assess *in vivo* the health benefits of dietary ingredients in various food matrices.

Benefits to Industry

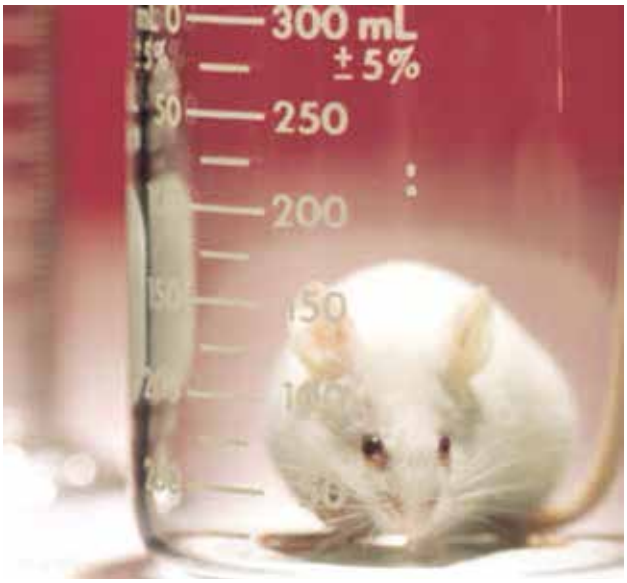
We can assist clients in testing efficacy of food ingredients using animal models. Animal studies are less costly than human studies and serve to predict biological functionality in humans.

Areas of Expertise

- foods for weight management, satiety, adiposity, muscle health, gut health and pregnancy.
- physiological, biochemical and molecular assessment of health.
- dietary challenges to pigs and mice.
- digestion and bioavailability of food ingredients.

Facilities/Equipment

- Dedicated research units to perform animal trials.
- State-of-the-art technology to measure physiological parameters such as food intake, body weight, body composition and locomotor activity, circulatory factors such as hormones, cellular activity (metabolic signals, enzymes, proteins, genes).



Range of solutions

We are able to perform short term (days) and long term (months) feeding trials in pigs and mice. In addition we can undertake post-prandial and gestational studies in pigs. We can investigate oral bioavailability, dosage and food formulation.

Of interest to

Functional food/ingredient manufactures

How to Proceed

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Agriculture and Food Development Authority

Technology

EXPERTISE

Centre for Membrane Applications Testing

With the recent extension of its membrane separation test facilities to span the range from laboratory to large scale pilot plant units, Teagasc researchers can make preliminary assessments of the potential for separation or enrichment of targeted compounds and molecules of interest from a diverse range of feedstocks. The accumulated experience of 45 years of membrane separations research at Moorepark in dairy can be brought to bear when deciding on applicability, membrane type, operating conditions, performance characterisation, specialised support analysis and process integration.

Background

The installation of a SEPA CF II crossflow membrane test cell at Moorepark for laboratory scale separation of diverse feedstocks complements the Centre's existing pilot plant facilities and provides fast and accurate performance data based on the use of minimal amounts of membrane and product before up-scaling. The SEPA CF II test cell is capable of testing any flat sheet membrane using crossflow velocities comparable with industrial plants. The unit is also capable of operating at the high pressures typically used in nanofiltration – thus extending it capability for selective ion and other low molecular weight separation. In addition, laboratory scale ultrafiltration charged membrane cassettes (Sartorius; Novasep) are also available to support protein fractionation and peptide separations.

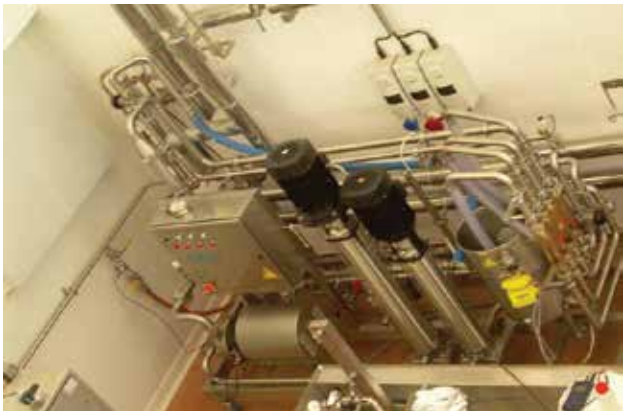
Benefits to Industry

Membrane separation processes are now mainstream within dairy manufacture e.g. nanofiltration (NF) for the partial demineralisation and pre-concentration of whey, ultrafiltration (UF) for production of whey protein concentrates and isolates, and microfiltration (MF) for defatting of whey and native casein separation. Membrane technology is currently playing a key process role in the manufacture of performance and recovery-based nutrition products derived from whey.

More and more opportunities are opening up for application of membrane-based separations. This is increasingly the case as membrane technology plays a central role in re-engineering traditional manufacturing processes to accomplish improved nutritional quality and sustainability.

Areas of Expertise

- Knowledge of potential fields of application.
- Collaboration with membrane developers and suppliers.



Facilities/Equipment

- Laboratory scale SEPA II crossflow test cell for testing of flat sheet membranes.
- GEA multi-membrane pilot scale.
- Membrain electrodialysis (ED) – laboratory and pilot scale units.

Range of Solutions

There are several possibilities by which companies can engage with Teagasc, from provision of service to contract or collaborative research.

Of interest to

- Dairy and Food Industry.
- Food Ingredient Manufacturers

How to Proceed

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Technology

EXPERTISE

Cheese Technology

Teagasc, through its resources at its Food Research Centre, Moorepark has extensive knowledge on the science and technology of a range of cheese types including Cheddar, Mozzarella and novel hybrid varieties. This knowledge, combined with an active ongoing research programme, offers the cheese industry a range of leading edge technologies to support the innovation of cheese products and optimisation of cheese making efficiency.

Background

The fundamental knowledge on the critical factors affecting the composition, yield, biochemistry, rheology, and cooking properties of natural cheeses and processed cheese products are well understood. Teagasc has been engaged in this research for many years with food research institutes and universities on national and international platforms.

Benefits to Industry

Engagement of cheese manufacturers with Teagasc gives access to state of the art facilities and an extensive research expertise in all aspects of cheese science and technology. This facilitates the innovation of new cheese products and optimisation of manufacturing efficiency.

Areas of Expertise

- Texture and functionality of natural cheese and processed-/analogue-cheese.
- Manufacturing efficiency and component recoveries.
- Cheese flavour control and diversification.
- Development, scale-up and diversification of a range of cheese types: brine salted, dry salted, reduced-fat variants.
- Advanced methodologies for assaying cheese texture and functionality.
- Range of analytical capabilities for composition, biochemistry, microbiology, rheology, and functionality.
- Ripening rooms, mixers, culture production unit for specialised starter blends.
- Filtration and dehydration equipment for manufacture of ingredients for use in cheese products.

Range of Solutions

Teagasc can provide a range of solutions through consultancy services, contract research and collaborative arrangements with industry, including:

- Identification and selection of micro-organisms with potential to influence flavour development.
- Development and scale-up of different cheese types.
- Increasing cheese making efficiency.

Facilities/Equipment

- Pilot plant facilities for milk standardisation equipment, pilot scale cheese vats 500-3000L.
- Cookers for processed-/analogue-cheeses.

How to Proceed

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Teagasc
Agriculture and Food Development Authority

Technology

EXPERTISE

Development of Ingredients Using Spray Drying

Teagasc through its resources at Moorepark combines considerable technological expertise with its state-of-the-art facilities in order to offer clients a range of innovative processing solutions for the development of ingredients using spray drying technology. This extends from powders for food service applications to nutritional formulations and tailored ingredients.

Background

Ongoing adaptation of the spray drying process is extending beyond milk to the wider food ingredient sector. Through extensive research, the know-how and facilities are available at Teagasc to address most client demands in spray drying for the purpose of ingredients development.

Benefits to Industry

Through engaging with Teagasc, access to state-of-the-art facilities and extensive expertise in ingredient evaluation and development is available to offer companies a range of innovative processing solutions, including powders for food service applications, nutritional formulations and tailored ingredients.

Areas of Expertise

(a) Powders for Food Service Applications

- Coffee-stable powders, imitation creamers.

(b) Powders for Nutritional Applications

- Evaluate ingredient behaviour on end-product stability.
- Intermediate ingredient pre-mixes with defined performance.
- Stabilised mineral fortified powders.
- High protein ingredients for sports nutrition use.
- Protein hydrolysates.

(c) Business-to-Business tailored ingredients

- High fat & microencapsulated fat-containing powders.
- High free fat powders for chocolate applications.
- Yogurt and other fermented powders.
- Powders customised to client needs.

Facilities/Equipment

- Pilot processing facilities.
- Moorepark Technology Ltd.
- Tall-form spray drying-Niro TFD-20 pilot scale drier to industrial specifications.

- Reconstruction processor, separation processor, evaporator and heating systems.
- Analytical facilities for analysis of powders.

Range of Solutions

Teagasc can provide a range of solutions including

- Evaluation of scale-up considerations during drying of new ingredients.
- Provision of innovative milk powder ingredients for evaluation.
- Evaluation and diagnosis of ingredient performances in spray dried formulations.
- Optimisation of pre-processing treatments.
- Analysis of powders.
- Advice on quality and food safety issues.

How to Proceed

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Teagasc
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Technology

EXPERTISE

Thermal Analysis of Foods

Teagasc researchers can provide specialist know-how, facilities and services in thermal analysis of foods and ingredients. This includes food materials and product process evaluation, stability studies and sample testing. Researchers at Teagasc Food Research Centre, Moorepark are available to carry out contract or collaborative research with companies in the aforementioned areas with a view to exploitation of novel ingredients, products/processes. A range of testing services and consultancy is also offered.

Background

An understanding of the influence of temperature on physicochemical/structural changes in food provides manufacturers with a mechanism for optimisation of processing conditions and, ultimately, improves product quality. Teagasc, with the support of the Teagasc Vision Program, recently installed state-of-the-art DSC and DMA instrumentation at Teagasc Food Research Centre, Moorepark. Methodologies have been developed and the instruments are validated for a comprehensive range of thermal analysis applications.

Benefits to Industry

This state-of-the-art thermal analysis equipment strengthens the research and development capabilities of the Irish food industry. This equipment enables the measurement of the physical properties of food materials and products and determination of their thermal and mechanical histories. Hence, thermal analysis will assist in the optimisation of processes used in food manufacture and the stability of foods in various environments.

Areas of Expertise

- Phase/state transitions of food ingredients.
- Crystallisation and melting behaviour of fat.
- Thermal properties of proteins, including thermal and freezing induced denaturation.
- Gelatinisation behaviour of starches and interactions with other ingredients.
- Oxidative decomposition, oxidation stability of food components.
- Mechanical relaxation of food ingredients.
- Mechanical and viscoelastic behaviour/properties of food.

Facilities/Equipment

- Differential Scanning Calorimetry (Q2000 Tzero DSC, TA Instrument).
- Dynamic Mechanical Analyser (Q800 DMA, TA Instrument).
- Humidity Control Unit and Liquid Nitrogen Cooling system.

Range of Solutions

There are several possibilities by which companies can engage with Teagasc, from provision of services, to contract or collaborative research.

Of Interest to

- Dairy and Food Industry.
- Food Ingredient and Infant Formula Manufacturers.

How to Proceed

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Technology

EXPERTISE

Whey Processing Capabilities

Teagasc has the expertise and experience to isolate and fractionate individual components of whey with a view to adding considerable value to these sought after protein ingredients. There is considerable commercial value in fractionation of individual whey proteins with well characterised functional and biological properties for use in consumer foods, nutraceutical and therapeutic applications.

Background

Whey protein is a mixture of a number of proteins that have their own unique nutritional, functional, physiological and nutraceutical properties. These properties are not fully exploited in whey protein concentrates and isolates, hence the value in characterising the individual whey proteins for their potential use in consumer foods, nutraceuticals and therapeutics. Teagasc, Moorepark, has extensive experience of working with companies in this area, as well as state-of-the-art facilities and equipment.

Benefits to Industry

Teagasc can assist manufacturers of whey products and end-users who use whey protein as an ingredient in formulated foods such as infant formula, sports and other beverage applications. Expertise is available for development, scale-up, optimisation and technology transfer of whey protein separation processes based on centrifugal and membrane filtration technologies. This should allow manufacturers of whey ingredients and nutritional beverages to develop new products centred on scientifically proven functional attributes.

Areas of Expertise

- Separation of whey protein fractions at laboratory and pilot scale and scale-up of processes.
- Optimisation/modification of existing whey protein separation processes.
- Analytical capabilities including HPLC electrophoresis, texture/rheology measurements, analysis of protein functionality, gelation, emulsification, foam formation, solubility.
- Engineering, rheology, microscopy and heat stability capabilities.

Facilities/Equipment

- Pilot plant facilities of Moorepark Technology Ltd.
- Cross-flow membrane filtration technology (tubular, spiral-wound, plate and frame).

- Centrifugal technology.
- Electro-dialysis plant 2500l/hr whey.
- Analytical instrumentation.

Range of Solutions

We can provide a range of solutions from technical services, contract production of whey fractions for market evaluation, consultancy and project management, to partnering in collaborative research in the area of whey processing.

Of Interest to

- Manufacturers of dairy ingredients and nutritional beverages including infant formula, medical and sports applications.
- Any companies using or interesting in adding value to their whey protein as an ingredient, from consumer foods to nutraceuticals to therapeutic applications.

How to Proceed

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Teagasc
Agriculture and Food Development Authority

Technology

Services

Technology

SERVICE

Anthelmintic Drug Residue Testing

Teagasc researchers at Ashtown are leading experts in the area of anthelmintic drug residue detection. They offer an analytical service covering a wide range of anthelmintic residues in meat, milk and dairy products. This unique method measures 40 substances and is available for the Irish agri-food industry as a specialist service from our accredited laboratories at Ashtown.

Background

Anthelmintics are one of the most widely used groups of veterinary medicines in the world. They are used in prophylaxis and therapeutic treatment of parasitic infections in livestock animals. The control of nematode (roundworm), cestode (tapeworm) and trematode (fluke) infections in food-producing animals is essential for maintaining animal health and the financial viability of primary producers of meat. Anthelmintic drugs used in livestock production include various benzimidazole compounds, imidazothiazoles, macrocyclic lactones and flukicides.

Maximum Residue Limits (MRLs) have been set for a number of these anthelmintic residues in milk and edible tissue including muscle, liver, kidney and fat to reduce the risk to human health. Only a few products are approved for dairy animals and have limits set in milk. The remainder are unapproved and a zero tolerance is applied.

Teagasc researchers developed a test that simultaneously measures 40 veterinary drug residues and are offering this test as a service to the agri-food industry.

Benefits to Clients

Under Directive 96/23/EC the food industry is required to have self-monitoring programmes in place to monitor for residues in food of animal origin.

By using this test you can be satisfied that you are in compliance with EU legislation and customer specifications.

This test will support industry in the export of food and gaining access to new markets.

Testing Details

The Ashtown method has been validated in liver, meat and milk samples according to the 2002/657/EC guidelines. The method is very sensitive and has a limit of quantitation of 1ìg/kg (ppb) for 38 residues, 2 ìg/kg for bithionol and clorsulon. The test includes avermectin, benzimidazole, flukicide and pesticide residues. The method has been accredited by the Irish National Accreditation Board.

How to Proceed

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Technology

SERVICE

Anticoccidial Residue Testing

Teagasc has developed an extensive test to measure anticoccidial residues in meat, milk and eggs. The method has been extensively validated at EU Maximum Residue Limits (MRLs) and Maximum Limits (MLs) set for non-target species.

Background

Anticoccidial drugs are widely used as additives in feed and as veterinary drugs for the prevention and treatment of coccidiosis in poultry and other animals.

MRLs and MLs have been set for a number of these anticoccidial residues to reduce risks to human health. In 2009, new MLs were set for non-target tissues to allow for the unavoidable carry-over of anticoccidials in non-target feed.

Teagasc has developed a test based on liquid chromatography coupled to tandem mass spectrometry (LC-MS/MS) that can measure up to 23 anticoccidials in eggs, meat and milk and is offering this test as a service to food companies.

Benefits to Clients

Under Directive 96/23/EC the food industry are required to have a self-monitoring programme in place to monitor for residues in food of animal origin.

By using this test you can be satisfied that you are in compliance with EU legislation and customer specifications.

Service Details

The Ashtown method has been validated according to the 2002/657/EC guidelines. The method is very sensitive and has a limit of quantitation of 2.5 µg/kg or less for most analytes. The method is currently accredited in egg and avian muscle. The method was accredited in 2012 by the Irish National Accreditation Board.

Table 1. The anticoccidial residues that can be measured using the Teagasc test.

Residue	Classification
EU Licensed	
Amprolium	Veterinary Drug
Cyromazine	Veterinary Drug
Decoquinate	Feed Additive & Veterinary Drug
Halofuginone	Feed Additive & Veterinary Drug
Imidocarb	Veterinary Drug
Lasalocid	Feed Additive
Maduramicin	Feed Additive
Monensin	Feed Additive & Veterinary Drug
Narasin	Feed Additive
Nicarbazin	Feed Additive
Robenidine	Feed Additive
Salinomycin	Feed Additive
Semduramicin	Feed Additive
Toltrazuril	Veterinary Drug
Toltrazuril Sulphoxide	Veterinary Drug
Toltrazuril Sulphone	Veterinary Drug
Not licensed in the EU	
Arprinocid	Feed Additive
Clopidol	Feed Additive
Diaveridine	Feed Additive
Laidlomycin	Feed Additive
Nequinate	Feed Additive

How to Proceed

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Technology

SERVICE

Bioactive Peptide Discovery Unit

The Bioactive Peptide Discovery Unit at Teagasc Food Research Centre, Moorepark is a world class facility, equipped to purify and characterise bioactive peptides produced by microorganisms, protein hydrolysis or fermentation. This facility and related capabilities can be accessed by research institutes, SME's, national and multinational companies with an interest in purifying, identifying, analysing or synthesising bioactive peptides for food or biomedical applications.

Background

Many dietary proteins contain 'encrypted' peptides, released upon enzymatic cleavage, identified as having specific bioactivities of commercial interest. Examples include peptides that can influence blood pressure (anti-hypertensive), inhibit undesirable microorganisms (antimicrobial) and prevent infection (anti-infectives). The bioactive peptides associated with these biological properties may be developed as functional food ingredients or for pharma/biomedical preparations. The identification and characterisation of these molecules is the first step in their path to commercialisation.

Competitive Advantage

The Bioactive Peptide Discovery Unit is a unique facility offering a one stop shop for those interested in any aspect of peptide identification, purification, analysis or synthesis.

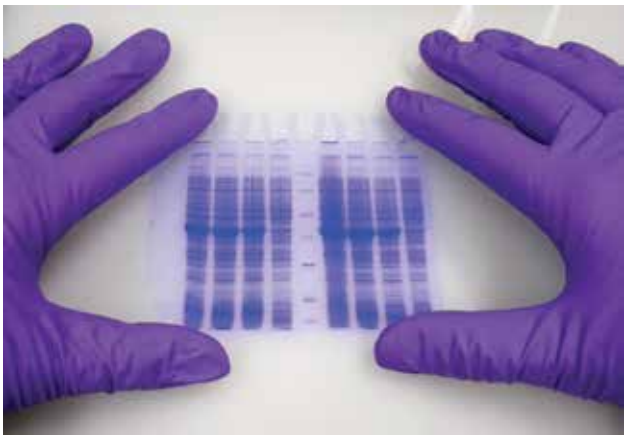
Facility and Service Details

The unit is equipped with:

- Nano, analytical and semi prep HPLCs.
- MALDI TOF mass spectrometer.
- Peptide synthesiser.
- Amino acid analyser.
- DIGE and 2D electrophoresis units.

Areas of Expertise Include

- Reverse phase, ion exchange, hydrophobic interaction and gel filtration chromatography.
- Molecular mass determination of peptides, and proteins, protein identification via peptide mass fingerprinting and peptide sequence confirmation via MS/MS using MALDI TOF mass spectrometry.
- Microwave Fmoc synthesis of peptides 6–50 amino acids long at 0.25 mM scale.



- Free amino acid analysis of biological samples and compositional analysis of proteins.
- Whole cell protein profiling using Difference In Gel Electrophoresis.

Service Interest to

This facility is primarily of interest to research institutes, SME's, national and multinational companies with an interest in purifying, identifying, analysing or synthesising bioactive peptides for food or biomedical applications.

How to Proceed

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Technology

SERVICE

Blown Pack Spoilage Testing (T-Bio®)

Teagasc researchers have developed a specialist blown pack spoilage (BPS) test which is available at Teagasc Food Research Centre, Ashtown as a service to the meat industry.

Background

Blown pack spoilage occurs in correctly chilled batches (0 to 2°C) of vacuum packaged beef after 4 to 6 weeks and is caused by Clostridium estertheticum and Clostridium gasigenes. This type of spoilage is characterised by the production of large volumes of gas (carbon dioxide), a putrid smell and a metallic sheen on the meat. Meat spoiled in this way has no commercial value.

Service Details

As part of the TBio technology transfer project, Teagasc (Ashtown) offers a testing service for Clostridium estertheticum and Clostridium gasigenes. Each test currently costs €15 and results are provided within 24-48 hours.

Of Interest to

The **T-Bio®** test is primarily of interest to the meat industry.

T-Bio®

How to Proceed

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Teagasc
Agriculture and Food Development Authority

Technology

SERVICE

Carbamate Pesticide Testing

This addition to Teagasc testing services allows for reliable and sensitive detection of 31 carbamate pesticides in animal tissue. This test confirmatory has now been validated to EU criteria.

Background

Carbamate pesticides are used worldwide to protect crops against a range of pests, due to their broad spectrum of insecticidal activity, effectiveness, and the nature of non-persistence in the environment. Despite their benefits, low levels of pesticide residues may remain in the crops, animal feeds or environment leading to contamination of the food chain. Exposure to pesticide residues in food is of considerable concern to consumers, food producers and regulators due to their subacute and chronic toxicity. Carbamates are of particular concern due to their anticholinesterase activity in the nervous system, which leads to an accumulation of the neurotransmitter, acetylcholine, at nerve terminals, causing subtle and long- lasting neurobehavioral impairment in humans. Symptoms of toxicosis include abdominal cramps, nausea, diarrhoea, salivation, miosis, dizziness, tremor, anxiety and confusion.

Service Details

By using this test you can be satisfied that you are in compliance with EU legislation and customer specifications. This will support you in exporting food and gaining access to new markets.

Benefits to Clients

The carbamates test, developed by Teagasc, allows the analysis of 31 residues in liver tissue using liquid chromatography coupled to tandem mass spectrometry (LC-MS/MS). The method uses a rapid QuEChERS sample preparation procedure, which can give faster turnaround time on your analysis.

The carbamates method was validated in liver samples according to the 2002/657/EC guidelines. The method is very sensitive and has a limit of quantitation ranging from 2 to 7.6 µg/kg. The method has been accredited by the Irish National Accreditation Board.

Table 1: The 31 residues that can be measured using the carbamates test.

Carbamate residue	
2,3,5 Trimethacarb	Methiocarb
3-Hydroxycarbofuran	Methiocarb sulphone
Aldicarb	Methiocarb sulphoxide
Aldicarb sulphone	Methomyl
Aldicarb sulphoxide	Molinate
Aminocarb	Oxamyl
Bendiocarb	Oxamyl oxime
Benthiavalicarb	Pebulat
Carbaryl	Pirimicarb des methyl
Carbofuran	Pirimicarb
Diethofenocarb	Propamocarb
Fenobucarb	Propoxur
Fenoxycarb	Prosulfocarb
Indoxacarb	Thiobencarb
Iprovalicarb	Triallat
Isoprocarb	

How to Proceed

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Technology

SERVICE

Consultancy in Food Quality Assurance

Teagasc, through its Food Research Centre at Ashtown, provides a unique specialist technical service package to state bodies, regulatory agencies and industry, especially SMEs. This package encompasses specialist technical advice and standards development, technology/ information transfer of research programme outputs and benchmarking through advanced technical assessment of completed processes.

Background

Emerging stringent legislative principles and quality assurance standards clearly place the responsibility for assuring food safety on food sector management. Commercial customers and retailers are conscious of the realities of market-place incidents and seek assurance from their suppliers on the adequacy and effectiveness of the control systems that are in place.

To address these requirements, food quality management systems (incorporating food safety) must increasingly be robust to meet such demands, whilst also remaining cost effective in order to meet commercial objectives. There is an increasing focus on the quality assurance chain incorporating traceability from farm to fork. This, together with renewed government support, has provided unprecedented challenges and opportunities for the Irish food sector and supporting organisations.

Benefits to Clients

Companies who implement and operate world class quality assurance standards enjoy the following benefits:

- Increased market access.
- Customer and consumer confidence.
- Enhanced ability to meet stringent legislative requirements.

Service Details

This is a confidential service. We work with the client to put together the most suitable package in terms of assessment, consultancy and implementation and may include the following service options:

- Independent audits of food/feed businesses against appropriate industry standards.
- Supplier audits.
- Pre-certification audits for various standards including Bord Bia, BRC etc.

- Confidential reports on levels of compliance and non-compliance with relevant legislation/standards.
- Technology capability assessments and advice.
- Trouble-shooting/ problem-solving.

Of Interest to

This service is relevant to food SMEs, state agencies and regulatory bodies, who wish to benefit from such specialist technical advice.

How to Proceed

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Technology

SERVICE

Flavour Profiling of Foods and Beverages

Teagasc has a state of the art flavour chemistry facility at the Teagasc Food Research Centre, Moorepark. This includes the capability to analyse volatile and non-volatile components of food that directly impact on flavour perception, using a wide range of advanced chromatographic equipment and software.

Background

Flavour is derived from approximately 75% aroma (odour) and 25% taste. The number of taste compounds is relatively limited to 'sweet', 'sour', 'salty', 'bitter' and 'umami', however other sensations and interactions exist that increase the complexity of taste, such as 'acid', 'hot', 'cooling', 'astringency' and 'mouth-coating'. The number of odour compounds is in the thousands which are made of a wide range of different chemical classes. We have extraction and separation methodologies designed to elucidate compounds that influence flavour either positively or negatively. Flavour chemistry can be used to support sensory analysis or as a stand alone discipline. The flavour chemistry facility undertakes research in a wide range of food and beverages directly within Teagasc research programs but also in collaboration with external research groups. It also provides a very active service to industry and has an extensive database of flavour compounds, whose origin and odour properties are known.

Capabilities on Offer

- Flavour profiling.
- Identification of odour active compounds.
- Olfactory analysis.
- Preference mapping.
- Product matching.
- Flavour shelf life.
- Identification of taints/off-flavours.
- Oxidative rancidity.
- Predictive modelling.
- Product quality.

Equipment

- Extraction.
- Thermal Desorption.
- Olfactory Analysis.
- Solid Phase Micro-Extraction.
- Purge & Trap.
- Steam Distillation.

Service Details

- Advanced chromatography mass spectrometry.
- Extraction Techniques (TD, SPME, ITEX, SE and Purge & Trap).
- Sniffing ports.

Of Interest to

Industry and academia involved in food and beverages, from production to packaging.

How to Proceed

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Technology

SERVICE

Grain Monitoring

Teagasc offer a National Grain Quality Monitoring Scheme to the grain trade, through Teagasc Food Research Centre, Ashtown. The purpose of this scheme is to ensure that all instruments, used in the measurement of the quality of grain at intake point during the harvest period, are providing uniform results.

Background

As grain is sold on a weight basis one of the most important characteristics at intake is the moisture level. Teagasc facilitate a National Grain Moisture Monitoring Scheme that ensures the standardisation of methods and instruments used across the country to measure grain quality at intake point during the harvest period.

Benefits to Clients

- Ensures moisture levels are accurate and grain producers are receiving adequate prices for their products.
- Participants of the Scheme can request additional moisture testing through Teagasc at a reduced rate.
- Protein determination is also provided at a rate of €30 per sample to Scheme participants. Protein levels are important as they can determine the end use of the grain and therefore the price.

Testing Details

Teagasc select raw grain samples from 8 different intake points around the country and analyse the grain for moisture content. Replicate samples are then sent to participating members of the Scheme who are asked to duplicate the analysis using their own equipment and the methods provided. Each member is provided with large standard samples at the beginning of the harvest. These standard samples are approximately 400g each for oven/ protimeter testing or 1000g for other moisture meters requiring a larger test sample. All samples will be provided in an airtight container to prevent moisture loss over the course of the harvest. The samples available are wheat, barley & oats.

Of Interest to

Grain producers

Nineteen companies are currently subscribed to the Scheme.

How to Proceed

For further information contact:

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Technology

SERVICE

High Throughput DNA Sequencing Platform

The Teagasc Sequencing Platform, available though resources at Teagasc Food Research Centre, Moorepark can bring the power of the cutting edge technologies to your DNA sequencing projects. This technology can be employed for whole genome di novo sequencing, transcriptome profiling, characterisation of the microbiology of food, environmental, animal and human samples, amplicon sequencing and more.

The Platform also has a dedicated, highly experienced, bioinformatics team to analyse and interpret the sequencing outputs

Background

DNA Sequencing technologies have been revolutionised in recent years. The Teagasc sequencing platform contains cutting edge technologies from Illumina, Ion and Oxford Nanopore.

These instruments have a range of applications:

- Whole genome sequencing.
- Targeted resequencing.
- 16S/ITS amplicon sequencing.
- Shotgun metagenomics.
- (Meta)transcriptome sequencing.

Competitive Advantage to Clients

- Range of different technologies available.
- Dedicated staff responsible for operating the technology and carrying out the associated bioinformatic analysis.
- Can contribute to DNA extraction, library preparation, quantification, QC where needed.
- Complementary equipment (PCR, qPCR, Qubit, Nanodrop, Bioanalyser, PCR workchambers)
- Software to facilitate analysis.
- Option of multiplexing multiple samples.
- Competitive prices.
- Dedicated bioinformatics team.

Service Details

Prices available on request

Of interest to

Institutes or bodies engaged in sequencing projects interested in accessing facilities providing improved sample throughput. There are also numerous potential industry-related applications such as assessing the impact of specific foods and ingredients on the gut microbiota and gut health, sequencing of probiotic strains, investigating animal genetics and many more.

How to Proceed

For further information contact:

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Technology

SERVICE

New Product Development for Food SMEs

Teagasc researchers and technologists have extensive knowledge, expertise and facilities available to support food businesses in new product development at its two food research centres at Ashtown and Moorepark. There is a special focus on supporting new product development (NPD) in SME and start-up food businesses.

Background

Advances in the food sector are accelerating the development of a wide range of new and improved, added-value products and services. The future success of the Irish food industry depends in large on its ability to be at the forefront of this scientific and innovative activity. Teagasc is committed to supporting the food processing sector and provides a range of supports including new product development services.

Benefit to Clients

The competitive position of food businesses is very dependent on their capacity to absorb new knowledge and skills and develop innovative products. Teagasc recognises the constant challenge faced by food companies and aims to support and assist them in the new product development process.

Product development supports are backed by the wide-ranging food research programme at Teagasc which has extensive linkages with food research institutes worldwide.

Support and Facilities

- Food development facilities are available at Teagasc Food Research Centres in Ashtown, Dublin and Moorepark, Cork.
- These include pilot and full scale regulatory approved production facilities containing modern equipment for the development of dairy, beverage, meat, bakery and prepared foods.
- Specially designed incubation units are available for sole use by client companies.
- Well-equipped and modern laboratories are available for microbiological, chemical, physical and sensory testing of products.

Of Interest to

Product development support is of interest to food processing businesses, and to suppliers of materials, services and development support to the food processing sector.

Service Contracts

Service contracts are agreed with clients and work is carried out on a confidential basis.

A schedule of fees is available on request for the various services provided.

How to Proceed

For further information contact:

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Carol Griffin
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Ciara McDonagh
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Technology

SERVICE

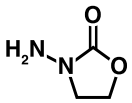
Nitrofuran Residue Testing

The Chemical Residues Laboratory at Ashtown offers a suite of analytical testing services. One of the most important of these is the nitrofuran test method, which tests for residues of nitrofuran antibiotic drugs in meat, plasma, fish, eggs and honey. This method represents an essential service for both importers and exporters of animal products.

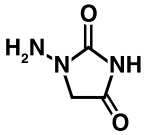
Background

Nitrofurans are a class of broad-spectrum antibiotics that were widely used in food-producing animals. Concerns about their potential toxicity resulted in them being banned for use in the EU in the 1990s. Despite this, nitrofuran contaminants remain a frequent source of alerts in the EU Rapid Alert System for Food and Feed (RASFF), with 72 cases of semicarbazide (the marker residue for nitrofurazone) in shrimp in 2009.

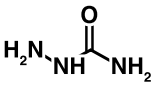
Teagasc have developed an assay that employs liquid chromatography coupled to tandem mass spectrometry (LC- MS/MS) to detect and quantify in a single analysis the metabolites of four of the main nitrofuran drugs (shown below). We are offering this test as a service to food companies. The test can ensure the absence of nitrofuran drug residues down to extremely low levels.



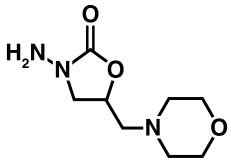
3-Amino-2-oxazolidinone (AOZ)



1-Aminohydantoin (AHD



Semicarbazide (SEM)



3-Amino-5-morpholinometh
2-oxazolidinone

Benefits to Clients

Under Directive 96/23/EC the food industry are required to have a self-monitoring programme in place to monitor for residues in food of animal origin.

By using this test you can be satisfied that you are in compliance with EU legislation and customer specifications.

Testing Details

The Nitrofurans test has been validated in liver, muscle, fish, plasma, egg and honey samples according to the 2002/657/EC guidelines. The method is very sensitive and has a limit of detection of <0.10 µg/kg for all four residues in most matrices. The method has been accredited by the Irish National Accreditation Board.

Figure 1: Analyst placing sample extracts for injection into liquid chromatograph for LC-MS/MS analysis

How to Proceed

For further information contact:

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Technology

SERVICE

Sensory Analysis

Teagasc, through its researchers and technologists at both its food research centres at Ashtown and Moorepark, has extensive knowledge, expertise and facilities available to identify the sensory requirements of food businesses and devise suitable testing methodologies.

Background

Sensory analysis is a scientific discipline used to measure and interpret reactions to foods as they are perceived by the senses (sight, sound, smell, taste and touch). It provides valid and accurate information on sensory characteristics using precise, documented techniques. People closely involved with a product frequently find it difficult to be objective when comparing it with those of competitors. Sensory analysis is used to judge the acceptability of products at many stages of product development (from concept to launch) and in quality control and quality assurance.

Benefits to Clients

Sensory Analysis provides a powerful tool in terms of new product development, and can be used anywhere in the NPD process from concept to launch and beyond in terms of quality assurance.

Teagasc sensory staff work closely with other Teagasc experts to correlate sensory and instrumental data. Off-flavour investigation is carried out in conjunction with our flavour chemists. Each client's needs are assessed and advice given on appropriate test methodology.

Service Details

- We carry out the full range of discrimination tests including triangle tests, tetrad, duo trio, paired comparison, and other tests as required.
- We have a trained descriptive panel experienced in the sensory analysis of a range of products.
- We provide expert advice to food businesses and help them devise the most suitable methodologies for their needs.
- Bespoke sensory training courses can also be developed on request.

Facilities

- We have state-of-the-art food preparation and sensory facilities.
- The testing facility comprises 8 individual booths each equipped with Compusense® 5.0 software for sensory data collection from panellists.
- The area is equipped with adjustable lighting and the temperature, ventilation and odour can be controlled.
- Training and conference rooms are also available for panellist training sessions and focus groups.

Of Interest to

Sensory evaluation is relevant to food processing businesses, ingredient manufacturers and suppliers, food service companies, retailers and distributors.

Service Contracts

Contracts are agreed with clients and work is carried out on a confidential basis. Cost is dependent on the method of testing used and sample numbers involved.

How to Proceed

For further information contact:

Carol Griffin or Carmel Farrell
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SERVICE

Specialised Training and Seminars

Teagasc provides specialised technical training and seminars for the food sector, in areas that include food safety, quality management, compliance with food legislation, and product development, through its Food Industry Training Programme. This programme is offered as a schedule of public courses to industry, development agencies and competent authorities each year. Delivery of customised training to companies is available on request. Seminars are also held each year covering topical issues of interest.

Background

The food sector is a knowledge intensive industry sector, with a continual need to upgrade knowledge and skills. The environment in which the industry operates is constantly changing in relation to regulatory, customer requirements, product lines and innovations. The Teagasc Food Industry Training Programme, through effective knowledge transfer and certification, enables the sector to keep abreast of these changes. The programme is quality assured, and course topics are updated regularly to reflect the changing needs of the sector.

Benefits to Clients

The Teagasc Food Industry Training Programme provides food businesses with up-to-date knowledge and skills required to keep up to date with changes in legislation, technology and good practice. This enables clients to compete effectively in the sector.

Courses are updated to ensure information is current and represents best practice. All trainers are highly qualified and experienced and many of the courses on offer are certified through the National Framework Quality Qualifications Ireland (QQI).

Service Details

The programme includes training in the following areas:

- Food Safety Management (HACCP).
- Quality Management (based on Third Party Standards).
- Systems Auditing.
- Laboratory Quality Management & Auditing.
- Trainer Skills.
- Compliance with Legislation & Labelling.
- Innovation Management and NPD.
- Dairy Product Manufacture & Cheese-making.

- Dairy Plant Operation, Spray-drying etc.
- Meat Processing & Butchery Skills.

A range of seminars are scheduled annually. Themes are chosen based on current topical issues and input from the food sector. Expert speakers are drawn from competent authorities, industry and the retail sector.

Of Interest to

This service is relevant to food industry personnel involved in technical or quality management, as well as supervisory staff, business owners & entrepeneurs, regulatory and development agency staff.

How to Proceed

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SERVICE

Technical Food Information Support

Teagasc provide a food information service that can help address the technical and practical questions that arise in the food industry. This is a key service for many food companies where keeping up-to-date may seem impossible with the amount of information being produced and the number of journal articles being published each week.

Background

Teagasc Food Research Centre, Ashtown provides an Information Service to help meet the continuous need of food companies for reliable and expert information. The service aims to address the technical and practical questions that can arise for the food industry. Topics include food safety issues, new developments and technologies, food marketing and food legislation.

Benefits to Clients

Teagasc have access to external databases and other information sources, including information generated from the extensive research programme of Teagasc plus national and international scientific linkages. These can be used to provide rapid food information solutions to companies operating in a competitive sector.

Service Details

Teagasc can provide the following Food Information Solutions:

- We can work with bespoke projects whether it is a food safety issue or processing problem.
- We can carry out an information search on a range of topics and provide a customised review to suit a product sector.
- We offer advice on accessing technology information sources.
- We can supplement a company's own resources and help to fill knowledge gaps.

This is a confidential service where we will work with the client to put together the most relevant information solution.

An appropriate fee will be agreed in advance.

Of Interest to

This service is of benefit to any food and related industries who need asistance in keeping up-to-date with technical and practical issues arising in the food industry.

How to Proceed

For further information contact:

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SERVICE

Testing for Agrochemical Residues

Teagasc is offering a range of analytical tests for the food industry for the detection and quantification of agrochemical residues in foods, through their well established laboratories at Teagasc Food Research Centre, Ashtown. Tailored analytical solutions can be developed upon request to provide more cost effective analysis.

Background

Veterinary drugs, feed additives and pesticides are used in the treatment of infections in food producing animals and can result in undesirable levels of residues in food. Regulatory agencies such as the Committee for Veterinary Medicinal Products and the European Food Safety Authority have set maximum residue limits (MRLs) for a range of agrochemical residues in food. The purpose of these MRLs is to protect public health and promote trade between countries.

Product labels on agrochemical products have been carefully prepared to ensure good agrochemical practice including application rates of products and withdrawal periods. If label claims are not carefully followed, non-compliant levels of residues can occur in food. The European Commission require each member state within the European Union to carry out national surveillance of their food production annually and demonstrate compliance with legislation. In addition, there are requirements on industry to carry out self-monitoring for residues, and it forms a basic part of a company's HACCP plan.

Competitive Advantage

- Teagasc has a long history in veterinary drug residue detection and the laboratories at our Food Research Centre, Ashtown have been accredited for this work for over 25 years.
- State-of-the-art ultra high performance liquid chromatography coupled to tandem mass spectrometry is used in the majority of such analyses, giving the best possible result to clients.
- Tailored analytical solutions can be developed on request to provide more cost effective analysis.

Testing Details

Some of the drug residues that we cover include:

- **Nitrofuran antibiotics** – 4 residues in liver, meat, eggs, honey and aquaculture products.
- **Anticoccidials** – 21 residues in eggs and meat.
- **Anticoccidials** – 8 residues in liver.
- **Anthelmintics** – 40 residues in liver, meat, milk.
- **Carbamate pesticides** in eggs, honey and liver.
- **Pyrethroid pesticides** in egg, fat and honey.

Of Interest to

These tests are relevant to all sectors of the Irish food industry. If we do not carry out a specific type of testing on site we can outsource the work at a highly competitive rate.

How to Proceed

For further information contact:

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Technology

Profiles

Technology

PROFILE

Declan J. Troy

Assistant Director of Research and Head of Technology Transfer

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Education

M.Sc. (Biochemistry) University College Dublin. 1987.

Graduateship of Royal Society of Chemistry, RSC, UK. 1982.

Career

2010–Present: Assistant Director of Research, Teagasc.

Head of Centre, Ashtown Food Research Centre, Teagasc.

Head of Meat Technology Department, Ashtown Food Research Centre, Teagasc.

Principle Research Officer, Ashtown Food Research Centre, Teagasc.

Expertise

Declan has published over 100 scientific peer reviewed publications, book chapters and scientific articles, mainly in the area of food / meat quality. The main focus of his research was on the biochemistry of muscle proteins and their effects on meat tenderness. Declan has always encouraged the up-take of science based innovations by the food industry and has interacted widely with the sector to this end. His work has contributed to the introduction of new technologies at industrial level particularly in Irelands competitive beef sector.

He has coordinated numerous EU meat science projects and has coordinated *ProSafeBeef*, a €20 million project with 41 transnational partners aimed at advancing beef safety and quality through research and innovation. This landmark project included close interaction with the meat science and industry community. He also coordinated two EU Framework Marie Curie Training Sites for early stage career meat science Ph.D. students in meat biochemistry and functional meat products. Currently he is the Director of the Marine Functional Food Research Initiative (NutraMara) a multidisciplinary programme aimed at discovering bioactive components from Irish marine sources for use in added value functional food products. He has collaborated in his research programme with many different research groups from all around the world including Australia, Korea and USA. He has been invited to speak at many international scientific conferences and industry seminars. He has supervised numerous Ph.D. students to completion. Declan sits on many national and international committees formulating research priorities in food science and advising state agencies and companies. Currently as Assistant Director of Research and Head of Technology Transfer, Declan is leading the Teagasc Technology Transfer Strategy.

Selected Publications

1. Byrne, C.E., Troy, D.J. and Buckley, D.J. (2000). Postmortem changes in muscle electrical properties of bovine *M.longissimus dorsi* and their relationship to meat quality attributes and pH fall. Meat Science, 54, 23–34.
2. Byrne, C.E., Downey, G., Troy, D.J. and Buckley, D.J. (1998) Non-destructive prediction of selected quality attributes of beef by near-infrared reflectance spectroscopy between 750 and 1098nm. Meat Science, 49 (4), 399–409.
3. Tsitsilonis, O.E, Stoeva, S., Echner, H., Balafas, A., Margomenou, L., Katsoulas, H.L., Troy, D.J., Voelter, W., Papamichail, M. and Lymberi, P. (2002) A skeletal muscle troponin –t ELISA based on the use of an antibody against the soluble troponin T (16–31) fragment. Journal of Immunological Methods 268 (2), 141–148.
4. Troy, D. J. and Kerry, J. (2010) Consumer perception and the role of science in the meat industry. Meat Science, 86, (1), 214–226.
5. Juárez, M., Marco,A., Brunton, N.,Lynch, B., Troy,D.J. and Mullen, A.M. (2009). Cooking effect on fatty acid profile of pork breakfast sausages enriched in conjugated linoleic acid by dietary supplementation or direct addition Food Chemistry, 117, (3), 1 393–397.

Technology

PROFILE

Dr. Mark Fenelon

Head of Food Research Programme

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Education

Diploma in Process and Chemical Engineering University College Cork. 2007.

Ph.D Food Science and Technology, University College Cork. 2000.

B.Sc. Dairy and Food Science, University College Cork. 1994.

Higher Diploma in Food Science and Technology. 1993.

Career

March 2015 –Present: Head of Food Programme (Ashtown and Moorepark Centres), Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork

Jun 2010–Present: Head of Food Chemistry & Technology Department, Teagasc Food Research Centre.

2004–2010: Principal Research Officer, Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork.

2000–2004: Food Technologist/ Project Manager at Wyeth Nutritionals, Askeaton, Co. Limerick.

Expertise

- Current programme focuses on ingredient interaction, i.e., protein – protein, protein – carbohydrate and protein – mineral interactions and impact during processing. Research includes improving the functional aspects of re-formulated foods in the nutritional beverage sector.
- Responsible for the recent development and implementation of the new separations / dehydration and ingredients facility located at Teagasc Food Research Centre, Moorepark.
- Experience includes chemistry and process related knowledge of dairy products including cheese, ingredients and infant formula. Knowledge of project management systems from both an academic and industrial perspective.

Selected Publications

1. Maher G. P., M. A Auty, Y. H. Roos, L.M. Zychowski and M. A. Fenelon. 2015. Microstructure and lactose crystallization properties in spray dried nanoemulsions. Food Structure Vol 3; 1–11.
2. Murphy, E.G., Y. H. Roos, S. A. Hogan, P. G. Maher, C. G. Flynn, and M. A. Fenelon. 2015. Physical stability of infant milk formula made with selectively hydrolysed whey proteins. *International Dairy Journal* 40; 39–46.
3. Maher G. P., Y. H. Roos and M. A. Fenelon. 2014. Physicochemical properties of spray dried nanoemulsions with varying final water and sugar contents. *Journal of Food Engineering*. Volume 126; 113–119.
4. Murphy, E.G., M.A. Fenelon, Y.H. Roos and S. A. Hogan. 2014. Decoupling Macronutrient Interactions during Heating of Model Infant Milk Formulas. Journal Agricultural & Food Chemistry 62; 10585−10593.
5. McCarthy, N. A., P. M. Kelly, P. G. Maher and M. A. Fenelon. 2014. Dissolution of milk concentrate (MPC) powders by Ultrasonication. *Journal of Food Engineering*. 126; 142–148.

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PROFILE

Dr. Paul Allen

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Education

B.Sc. Biological Sciences, University of Exeter.

M.Sc. Applied Genetics University of Birmingham.

Ph.D. Faculty of Agriculture, NUI University College Dublin.

Certified Diploma in Accounting and Finance, ACCA.

Career

1977–1978: Genetics Advisor, Meat and Livestock Commission, UK.

October 1978–Present: Member of the Research Staff at Teagasc Food Research Centre Ashtown in the Food Chemistry and Technology Department, specialising in meat research.

Expertise

- Automated and non-invasive methods of carcass grading and evaluation.
- Factors affecting meat quality.
- Meat packaging.
- Meat processing.
- Healthier meats.
- Imaging methods to predict eating quality.
- Novel processing.

Selected Publications

1. Jackman, P., Sun, D.-W., Allen, P., Brandon, K. and White, A. (2010). Correlation of consumer assessment of *longissimus dorsi* beef palatability with image colour, marbling and surface texture features. Meat Science, 84, 564–568.
2. Hayes, J., Stepanyan, V., Allen, P., O'Grady, M.N. and Kerry, J.P. (2010). Effect of lutein, sesamol, elagic acid and olive leaf extract on the quality and shelf-life stability of packaged raw minced beef patties. Meat Science 84, 613–620.
3. Romvari, R., Dobrowolski, A., Repa, I., Allen, P., Olsen, E., Szabo, A. and Horn, P. (2006). Development of a computed tomographic calibration method for the determination of lean meat content in pig carcasses. Acta Veterinaria Hungarica, 2006, 54, 1–10.
4. Beggan, M., Allen, P. and Butler, F., (2006). Effect of oxygen concentrations on blooming ability of aged beef *longissimus lumborum* steaks following ultralow oxygen and vacuum storage. Journal of Muscle Foods, 2006,17, 267–276.
5. Sorenson, D., Henchion, M., Marcos, B., Ward, P., Mullen, A.M. and Allen, P. (2011). Consumer acceptance of high pressure processed beef-based chilled ready meals: The mediating role of food-related lifestyle factors. Meat Science 87, 81–87.

Technology

PROFILE

Dr. Carlos Álvarez

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Phone: +353 (0)1 8059749

Education

B.Sc. Univerisity of Oviedo, Spain. 2004

Master's degree, University of Oviedo, 2006

Ph.D. University of Oviedo, Spain. 2012

Career

2012–2013: Researcher in "Bloodin" project. University of Oviedo, Spain.

2013–2014: Technical Advisor in Chemical Engineering Department, University of Oviedo, Spain.

2014–Present: Post-Doctoral Research at Teagasc, project NutraMara

2014-to date: Research Officer on ReValue Protein project, Teagasc

Expertise

Carlos Álvarez obtained his doctorate in the University of Oviedo (Spain) in 2012. His research work focused on the characterisation of isolated proteins from porcine blood, based on their functional and antioxidant properties. Through this project he has collaborated with several companies aiming to develop new food products containing blood purified proteins. He then joined NutraMara project as a Post-doctoral student. Within this project new techniques were developed aiming to recover proteins, peptides, amino acids, minerals and fatty acid from several fisheries wastes (frames, guts, heads, shells or mollusc flesh). Currently he is a Research Officer on the FIRM funded project ReValue Protein, focusing on the recovery and re-valorisation of molecules of high-added value from waste and by-products of the meat industry such as blood, lungs, heart and other offal. As a researcher, his main interest is in developing and applying new methodologies such as ultrasound, isoelectric solubilisation-precipitation, enzymatic assisted extraction and tailoreded processes for specific raw materials to increase the value of meat industry by-products.

Selected Publications

1. A. M. Mullen and C. Álvarez, Offal: Types and Composition, In Encyclopedia of Food and Health, edited by Benjamin Caballero, Paul M. Finglas and Fidel Toldrá, Academic Press, Oxford, 2016, Pages 152–157.
2. Ojha, K. S., Alvarez, C., Kumar, P., O'Donnell, C. P., & Tiwari, B. K. (2016). Effect of enzymatic hydrolysis on the production of free amino acids from boarfish (Capros aper) using second order polynomial regression models. *LWT-Food Science and Technology*, 68, 470–476.
3. Marcet, I., Álvarez, C., Paredes, B., & Díaz, M. (2016). The use of sub-critical water hydrolysis for the recovery of peptides and free amino acids from food processing wastes. Review of sources and main parameters. Waste Management, 49, 364–371.
4. Álvarez, C., Tiwari, B. K., Rendueles, M., & Díaz, M. (2016). Use of response surface methodology to describe the effect of time and temperature on the production of decoloured, antioxidant and functional peptides from porcine haemoglobin by sub-critical water hydrolysis. *LWT-Food Science and Technology*.
5. Anne Maria Mullen, Carlos Álvarez, Milica Pojić, Tamara Dapčević Hadnadev and Maria Papageorgiou, Chapter 2 – Classification and target compounds, In Food Waste Recovery, edited by Charis M. Galanakis, Academic Press, San Diego, 2015, Pages 25–57.

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PROFILE

Dr. Mark A.E. Auty

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Phone: +353 (0)25 42222

Education

Ph.D. Dairy Chemistry (University College Cork) 2004.

B.Sc. Microbiology (Surrey) 1985.

Fellow of the Royal Microscopical Society.

Career

1997–Present: Senior Research Officer, Food Chemistry and Technology Department, Moorepark; manager of the National Food Imaging Centre. Since joining Teagasc, Mark has published 39 peer reviewed scientific articles and generated > €2m in research funding.

1985–1996: Senior Scientist at Leatherhead Food International.

Expertise

Dr. Auty is a food structure expert with over 25 years' experience in applying microstructural and rheological analysis to understanding food functionality. Particular research interests include food nanotechnology and relating the microstructure of food ingredients and products to processing and consumption. Mark provides specialist expertise for a wide range of projects at Teagasc, including projects on protein functionality, powders, cheese, probiotics, fermented milks, cereals and meat products. His expertise is in regular demand from industry. With a strong international reputation, he gives many invited and keynote presentations in Europe, the US and China.

Selected Publications

1. Ciron, C.I.E., Kelly, A.L. and Auty, M.A.E. (2012). Modifying the microstructure of low-fat yoghurt by microfluidization of milk under different pressures to enhance rheological and sensory properties. Food Chemistry, 130: 510–519.
2. Abhyankar, A.R., Mulvihill, D.M. and Auty, M.A.E. (2011). Combined microscopic and dynamic rheological methods for studying the structural breakdown properties of whey protein gels and emulsion filled gels. Food Hydrocolloids, 25: 275–282. (8th out of top 25 hottest topic articles in 2011).
3. Oboroceanu, D., Wang, L., Kroes-Nijboer, A., Brodkorb, A., Venema, P., Magner, E. & Auty, M.A.E. (2011). The effect of high pressure microfluidization on the structure and length distribution of whey protein fibrils. *International Dairy Journal*, 21: 823–830.
4. Ciron, C.I.E, Kelly, A.L., Auty, M.A.E. (2011). Effect of microfluidization of heat-treated milk on rheological and sensory properties of reduced-fat yoghurt. Food Hydrocolloids, 25: 1470–1476.
5. Oboroceanu, D., Wang, L., Brodkorb, A., Magner, E., Auty, M.A.E. (2010). Characterization of β-lactoglobulin fibrillar assembly using atomic force microscopy, polyacrylamide gel electrophoresis and *in situ* Fourier transform infrared spectroscopy. Journal of Agricultural and Food Chemistry, 58: 3667–3673. (Top 20 cited article in past 3 years).

Technology

PROFILE

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Education

B.Sc. University College, Cork, Ireland. 1985

Ph.D. University College, Cork, Ireland. 1991

Research Experience

1990–1991: Post Doctoral Research Scientist BioResearch Ireland, University College Cork.

1991–1993: Post Doctoral Research Scientist New Zealand Dairy Research Institute.

1993–2000: Research Officer.

2000–2002: Senior Research Officer.

2002–2005: Principle Research Officer.

2005–Present: Senior Principle Research Officer Teagasc Food Research Centre, Moorepark.

Management Experience

2000–2004: Acting Head, Cheese Department.

2004–2009: Head, Food Cultures & Safety Department.

2009–Present: Head, Food Biosciences Department.

Expertise

My primary research interests relate to aspects of cheese microbiology, in particular, the influence of various starter and non-starter organisms on the biochemistry of cheese ripening. Of particular interest is the contribution of *Lactobacillus helveticus* as a cheese ripening organism. As part of this work the complete sequence of DPC4571, an *L. helveticus* strain with interesting technological characteristics from the Moorepark culture collection, has been elucidated. A particular focus of my current research relates to the potential of bacterial exopolysaccharide to impact on both the techno – and bio-functionality of dairy products. In addition, I am interested in microbial fermentation with particular reference to the capacity of a range of bacteria to release bioactive peptides from protein molecules. I also undertake research on microbial quality of milk.

Selected Publications

1. Callanan, M.J., Kaleta, P., O'Callaghan, J., O'Sullivan, O., Jordan, K.N., McAuliffe, O., Sangrador-Vegas, A., Slattery, L., Fitzgerald, G. F., Beresford, T.P., Ross, R.P. (2008) Genome sequence of *Lactobacillus helveticus*, an an organism distinguished by selective gene loss and insertion sequence element expansion. *Journal of Bacteriology,* 190, 2, 727–735.
2. Kaleta, P., O'Callaghan, J., Fitzgerald, G.F., Beresford, T.P., Ross, R. P. (2010) Crucial role for insertion sequence elements in *Lactobacillus helveticus* evolution as revealed by interstrain genomic comparison. *Applied & Environmental Microbiology* 76, 1, 212–220.
3. Costa, N.E., Hannon, J.A., Guinee, T.P., Auty, M.A.E., McSweeney, P.L.H and Beresford, T.P. (2010) Effect of exopolysaccharide produced by isogenic strains of *Lactococcus lactis* on half-fat Cheddar cheese. *Journal of Dairy Science* 93, 3469–3486.
4. Slattery, L., O'Callaghan, J., Fitzgerald, G.F., Beresford, T.P., and Ross, R.P. (2010) Invited review: *Lactobacillus helveticus* – A thermophilic dairy starter related to gut bacteria. *Journal of Dairy Science* 93, 4435–4445.
5. Quigley, L., O'Sullivan, O., Beresford, T., Ross, R.P. Fitzgerald, G.F. and Cotter, P. (2011). Molecular approaches to analyzing the microbial composition of raw milk and raw milk cheese. *International Journal of Food Microbiology* 150, 81–94.

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Agriculture and Food Development Authority

Technology

PROFILE

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Education

Ph.D. Factors Affecting Milk Protein Composition, 1980

B.Sc. Biochemistry with Microbiology, 1977

Career

1988–Present: Food Industry Development, Teagasc Food Research Centre, Ashtown

1982–1986: Technical & Operations Management Meat Processing Sector

1980–1982: Teagasc Researcher, Dairy Research Centre, Moorepark.

Expertise

- Design, development and delivery of training courses.
- Food Safety Systems / HACCP
- Implementation of Quality Management Systems in.
- Food, Feed & Laboratory areas.
- Internal & Third Party auditing of Food Safety & Quality Management Standards.
- Internal auditing in Competent Authorities.
- Standards Development.

Projects include:

- Development of Certified Training Programmes.
- Design & delivery of specialised training to Competent Authorities and Development Agencies.
- Delivery of training across a range of food safety related topics including microbiology, HACCP, food standards, auditing, laboratory accreditation etc.
- Organisation and delivery of a range of seminars on topics of interest to the food industry.
- Addressing varied client queries in the area of food safety & quality, including legislative and standards requirements (e.g. BRC, Bord Bia, ISO 22000 etc).
- Problem solving and shelf-life extension.

Selected Publications

1. Barry G, Clancy M (1998) Food Catering, A Serious Business. *Hotel and Catering Times* October/ November Ed. P 4–7.
2. Doyle T, Barry (1994). Food Safety The Systematic Approach. *Food Ireland*, June Edition, P17–20.
3. Barry G (2010). Ensuring Good Food Standards, *T Research*, Volume 5, Number 1, Spring 2010 Pages 20–21 (ISSN 1649–8917).
4. Barry (2012) Shelf-life of Food, *T Research*, Volume, Number 1, Spring 2012 Pages 20–21 (ISSN 1649–8917).

Technology

PROFILE

Dr. Declan Bolton

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Education

B.Sc. University College Dublin, Ireland. 1991

Ph.D. University College Dublin, Ireland. 1995

Grad. Dip. Business, NCEA, Ireland. 1996

Career

Research Assistant (University College Dublin) (1990)

Research Scientist (USDA-ERRC, Philadelphia) (1996)

Research Officer, Teagasc (1996–2003)

Senior Research Officer, Teagasc (2003–2006)

Principal Research Officer, Teagasc (2006 to date)

Member of the European Food Safety Authority, Biohazard Panel, Parma, Italy, (2012 to date)

Expert Consultant, FAO/WHO, Rome, Italy (2015)

Expertise

- **Food safety microbiology** including *Campylobacter*, *Escherichia coli* O157/VTEC, *Salmonella* and other foodborne bacterial pathogens.
- **Food spoilage microbiology** including blown pack spoilage (*Clostridium estertheticum, Clostridium gasigenes*, etc.) and shelf-life.
- **Food safety, shelf-life, HACCP and pre-requisites (GMP and GHP)** for beef, pork lamb, poultry, fish and foods of non-animal origin (vegetables, cereals, fruit, etc.) including primary production, processing, transport, retail and catering.

Selected Publications

1. Leonard Koolman, Paul Whyte, Joseph Meade, James Lyng, Declan Bolton (2014). Use of chemical treatments applied alone and in combination to reduce Campylobacter on raw poultry. *Food Control*, 46, 299–303.
2. Declan J. Bolton (2015) Campylobacter virulence and survival factors. Food Microbiology, 48, 99–108.
3. Leonard Koolman, Paul Whyte, Catherine Burgess and Declan J. Bolton (2015). Distribution of virulence-associated genes in a selection of Campylobacter isolates. Foodborne Pathogens and Disease, 12 (5), 424–433.
4. Declan J. Bolton, Des Walsh and Joan Carroll (2015). A four year survey of blown pack spoilage Clostridium estertheticum and Clostridium gasigenes on beef primals. Letters in Applied Microbiology, 61(2), 153–157.
5. Leonard Koolman, Paul Whyte, Catherine Burgess and Declan Bolton (2016) Virulence gene expression, adhesion and invasion of Campylobacter jejuni exposed to oxidative stress (H2O2). *International Journal of Food Microbiology*, 220, 33–38.
6. Tara Battersby, Paul Whyte and Declan J. Bolton (2016) The pattern of Campylobacter contamination on broiler farms; external and internal sources. *Journal of Applied Microbiology*, 102, 1108–1118.
7. Tara Battersby, Paul Whyte and Declan Bolton (2016). Protecting broilers against Campylobacter infection by preventing direct contact between the farmer and broilers. *Food Control*, 69, 346–351.

Technology

PROFILE

Kevin Brennan

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Education

M.Sc. Food Science, University of Reading (UK).

Food Microbiology, Institute of Technology, Co. Carlow.

Certificate in IT (computer systems) Institute of Technology, Blanchardstown.

Certificate in Equine AI and veterinary treatment.

Career

Current since 1996: Teagasc Food Research Centre, Ashtown, Dublin 15.

SGS Yarsley Ltd, Leopardstown Business Park, Co. Dublin.

Bioresearch Ireland Ltd, National Biotechnology Research Centre, University College Cork.

SGS Yarsley UK Ltd, Redhill, Surrey, UK.

Expertise

- Providing specialised training, consulting & independent contract technical auditing services (Bord Bia MPQAS, BRC and contract internal auditing) to the food sector, regulatory authorities and development agencies.
- Development and implementation of food safety and quality assurance standards. (incorporating: animal welfare, farm to fork traceability, food safety and quality).
- Technology/knowledge transfer of ready to use food safety research outputs to SMEs.
- Development of practical interpretative guides for SMEs in relation to application of food safety legislation.
- Animal welfare training and competency assessment in line with current animal welfare regulations.

Selected Publications

1. Brennan, K.A. (2013) Traceability and identification of Horse meat, Teagasc TReseach.
2. Brennan, K.A. (2012) Quality assurance and microbiological criteria regulations, Teagasc TResearch.
3. Brennan, K.A., Compliance with EC reg 2073/2005 – red meat sampling, Institute of Food Science and Technology 'Food Science and Technology Ireland' Volume 2, July 2008.
4. Brennan, K.A., Guidance note NFC/3/2007 'Microbiological Criteria for Food Stuffs – red meat specific', April 2007, ISBN 1 84170 449 0.
5. Brennan, K.A. & Langan J.W. (2003), Guidance Note on the implementation of the microbiological testing procedures and interpretation of results as required by European Communities (Fresh Meat and Poultry Checks on General Hygiene) Regulations 2003 (redmeat specific), Training Guidance Note No: NFC/Meat/1/2003, ISBN 1 84170 331 1.
6. Brennan, K.A. (2003), Guidance Note on the implementation of the microbiological testing procedures and interpretation of results as required by European Communities (Fresh Meat and Poultry Checks on General Hygiene) Regulations 2003 (poultry specific), Training Guidance Note No: NFC/Meat/2/2003, ISBN 1 84170 346 X.
7. Brennan, K.A., Food Safety Management and Audit, proceedings of EU-RAIN international conference, Dublin December 1–2nd 2006.
8. Brennan, K.A. (1999), HACCP Certification and I.S. 343, Proceedings of International Quality Conference, Dublin, October 1999.
9. Brennan, K.A. (1998), Dissemination of Food Safety and Quality Research in Europe, Proceedings of International Meat Conference, Madrid, Spain.

Technology

PROFILE

Dr. André Brodkorb

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Education

1995: Degree in chemistry, Friedrich Schiller Universität Jena, Germany

2001: Ph.D. in bio-physical chemistry, Université Libré de Bruxelles, Belgium

Career

2001–2002: Post-doctorate in bio-physical chemistry, Trinity College Dublin

2002–Present: Research officer in Teagasc Food Research Centre, Moorepark

Expertise

- Protein Structure/Function relationship; Structure = molecular structure (primary, secondary and tertiary), modification, and aggregation; Function = physico-chemical properties (e.g. gelation, viscosity, emulsification, hydrophobicity), bio-activity.
- *In vivo and* and *in vitro* gastro-intestinal digestion of food and food components.
- Bioencapsulation – protection of sensitive food ingredients e.g. probiotic bacteria, during processing, storage and gastro-intestinal digestion.
- Bioactivity and structure of novel protein/ligand complexes.
- Separation and fractionation of proteins/peptides – development and evaluation of novel chromatographic and non-chromatographic purification and fractionation of mainly globular proteins and proteolytic fractions thereof.

Selected Publications

1. Minekus, M., Alminger, M., Alvito, P., Ballance, S., Bohn, T., Bourlieu, C., Brodkorb, A. (2014). A standardised static *in vitro* digestion method suitable for food – an international consensus. *Food & Function*, 5(6), 1113–1124.
2. O'Loughlin, I. B., Murray, B. A., FitzGerald, R. J., Brodkorb, A., & Kelly, P. M. (2014). Pilot-scale production of hydrolysates with altered bio-functionalities based on thermally-denatured whey protein isolate. *International Dairy Journal*, 34, 146–152.
3. Sullivan, L. M., Kehoe, J. J., Barry, L., Buckley, M. J. M., Shanahan, F., Mok, K. H., & Brodkorb, A. (2014). Gastric digestion of α-lactalbumin in adult human subjects using capsule endoscopy and nasogastric tube sampling. *British Journal of Nutrition*, 112, 638–646.
4. O'Loughlin, I. B., Murray, B. A., Kelly, P. M., FitzGerald, R. J., & Brodkorb, A. (2012). Enzymatic hydrolysis of heat-induced aggregates of whey protein isolate. *Journal of Agricultural and Food Chemistry*, 60(19), 4895–4904.
5. Doherty, S. B., Auty, M. A., Stanton, C., Ross, R. P., Fitzgerald, G. F., & Brodkorb, A. (2012). Survival of entrapped *Lactobacillus rhamnosus* GG in whey protein micro-beads during simulated ex vivo gastro-intestinal transit. *International Dairy Journal*, 22(1), 31–43.
6. Kehoe, J. J., Wang, L., Morris, E. R., & Brodkorb, A. (2011). Formation of non-native β-lactoglobulin during heat-induced denaturation. *Food Biophysics*, 6(4), 487–496.

Technology

PROFILE

Dr. Kaye Burgess

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Education

Ph.D. Microbiology, University College Cork

B.Sc. (Hons) Microbiology, University College Cork (1H)

Career

Sept 2005–Present: Research Officer, Teagasc Food Research Centre Ashtown

June 2005–Aug 2005: Postdoctoral researcher, Department of Microbiology, University College Cork

Expertise

My research focus is on using molecular tools to provide an understanding of the behaviour and virulence of microbial pathogens, in particular Gram-negative pathogens, along the farm to fork chain. I am particularly interested in the role that stresses encountered in the food chain may have on the virulence and persistence of foodborne pathogens, such as verocytotoxigenic E. coli (VTEC). Current activities include coordination of projects on identifying traits which contribute to persistence of VTEC in the primary production environment and reducing L. monocytogenes biofilm formation on food industry surfaces. I am a work package leader on the EU FP7 funded project Aquavalens, which is socused on technologies to ensure the safety of European drinking water supplies. I am also a work package leader on the EU COST Action BacFoodNet which is focused on bacterial colonisation of foods and food contact surfaces. Other areas of interest include novel detection methods for pathogens and spoilage organisms, the use of biological agents for the control of foodborne pathogens and antimicrobial resistance.

Selected Publications

1. Lenahan M., Sheridan A., Morris D., Duffy G., Fanning S., and C.M. Burgess (2014). Transcriptomic analysis of triclosan-susceptible and – tolerant Escherichia coli O157:H19 in response to triclosan exposure. Microb Drug Resist. 20(2): 91–103.
2. Sheridan Á., Lenahan M., Condell O., Bonilla-Santiago R., Sergeant K., Renaut J., Duffy G., Fanning S., Nally J.E., and C.M. Burgess. (2013) Proteomic and phenotypic analysis of triclosan tolerant verocytotoxigenic Escherichia coli O157:H19. J Proteomics 80: 78–90.
3. Sheridan Á., M. Lenahan, G. Duffy, S. Fanning and C.M. Burgess (2012). The potential of biocide tolerance in Escherichia coli and its impact on the response to food processing stresses. *Food Control*, 26:98–106.
4. Murphy S, Gaffney M, Fanning S and Burgess CM (2016) Potential for transfer of Escherichia coli O157:H7, Listeria monocytogenes and Salmonella Senftenberg from contaminated food waste derived compost and anaerobic digestate liquid to lettuce plants. Food Microbiol 59:7–13.
5. Burgess CM, Gianotti A, Gruzdev N, Holah J, Knøchel S, Lehner A, Margas E, Esser SS, Sela Saldinger S, Tresse O (2016). The response of foodborne pathogens to osmotic and desiccation stresses in the food chain. Int J Food Microbiol 221:37–53.
6. McCabe E.M., Burgess C.M., O'Regan E., McGuinness S., Barry T., Fanning S., Duffy G. (2011) Development and evaluation of DNA and RNA real-time assays for food analysis using the hilA gene of Salmonella enterica subspecies enterica. Food Microbiol. 28(3):447–56.
7. Dolan, A., Burgess C.M., Fanning S. & G. Duffy, (2010) Application of quantitative reverse-transcription PCR (qRT-PCR) for the determination of the total viable count (TVC) on meat samples. J Appl Microbiol 109: 91–98.

Technology

PROFILE

Sarah Cahalane

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Education

BA. Natural Science, Trinity College Dublin, 2002

M.Sc. Dublin City University, 2004

Career

2004–2006: Immunology Research Assistant, St. Vincent's University Hospital, Dublin 4

2006–2008: Research Funding and Lab Manager, Comparative Immunology Lab, Trinity College Dublin, Dublin 2

2008–2010: Evaluation Officer, Teagasc, Carlow

2010–Present: Intellectual Property Support Officer, Teagasc, Carlow

Expertise

My scientific background is essential to my position within the Teagasc Technology Transfer Office (TTO). In my role in the TTO I assist and provide support to the Head of the Intellectual Propoerty (IP) Management unit and facilitate interactions between Teagasc research staff, Industry and other research performing organisations through the use of transparent, consistent and equitable IP management and technology transfer policies.

I am involved in drafting, reviewing and negotiating research agreements which range from simple non-disclosure agreements to more complex consortium agreements, contract research and collaboration agreements. I am responsible for presenting the Teagasc TTO's capabilities and activities on our website (www.teagasc.ie/research/collaboration) and I actively participate in the promotion of Teagasc's technologies at Technology Transfer events.

Selected Publications

1. Higgs, R., Cormican, P., Cahalane, S., et al. (2006) Induction of a novel chicken toll-like receptor following *Salmonella enterica* serovar *Typhimurium* infection. *Infection and Immunity* 74, 1692–1698.
2. Higgs, R., Lynn, D.J., Cahalane, S., et al. (2007) Modification of chicken avian beta-defensin-8 at positively selected amino acid sites enhances specific antimicrobial activity. *Immunogenetics* 59, 573–80.
3. Meade, K.G., Cahalane, S., Narciandi, F., et al. (2008) Directed alteration of a novel bovine beta-defensin to improve antimicrobial efficacy against methicillin-resistant *Staphylococcus aureus* (MRSA). *International Journal of Antimicrobial Agents* 32, 392–97.
4. Cormican, P., Meade, K.G., Cahalane, S., et al. (2008) Evolution, expression and effectiveness in a cluster of novel bovine beta-defensins. *Immunogenetics* 60, 147–56.

Technology

PROFILE

Mairéad Coakley

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Education

B.Sc. Microbiology, University College, Cork (1994)

M.Sc. Microbiology, University College, Cork (1996)

Dip. Brewing, Institute of Brewing and Distilling, London (2000)

Career

1996–2001: Research Officer, Diageo, Dublin

2001–2006: Research Officer, Teagasc, Moorepark

2008–2013: Researcher, ELDERMET, University College Cork and Teagasc, Moorepark

2014–Present: Technologist, APC Microbiome Institute and Teagasc, Moorepark

Expertise

- Isolation, differentiation and identification of bacteria and yeast from food and clinical samples.
- Mining the GIT for bacterial strains of interest and assessment of factors that influence the gut microbiota.
- Culture collection generation and curation.
- Techniques relating to classical microbiology and molecular biology.
- Screening of bacteria for probiotic properties e.g. CLA production.
- Fermentation technology.

Selected Publications

1. Lakshminarayanan, B., Harris, H.M., Coakley, M., O'Sullivan, Ó., Stanton, C., Pruteanu, M., Shanahan, F., O'Toole, P.W. and Ross, R.P. (2013) Prevalence and characterization of *Clostridium perfringens* from the faecal microbiota of elderly Irish subjects. J. Med. Microbiol. 62: (3):457–66.
2. Lakshminarayanan, B., Guinane, C.M., O'Connor, P.M., Coakley, M., Hill, C., Stanton, C., O'Toole P.W., Ross R.P. (2013) Isolation and characterization of bacteriocin-producing bacteria from the intestinal microbiota of elderly Irish subjects. J Appl Microbiol. 114(3):886–98.
3. O'Sullivan, Ó., Coakley, M., Lakshminarayanan, B., Conde, S., Claesson, M.J., Cusack, S., Fitzgerald, A.P., O'Toole, P.W., Stanton, C. and Ross R.P. (2013) Alterations in intestinal microbiota of elderly Irish subjects post-antibiotic therapy. J. Antimicrob. Chemother. 68(1):214–21.
4. Claesson, M.J., Jeffery, I.B., Conde, S., Power, S.E., O'Connor, E.M., Cusack, S., Harris, H.M., Coakley, M., Lakshminarayanan, B., O'Sullivan, O., Fitzgerald, G.F., Deane, J., O'Connor, M., Harnedy, N., O'Connor, K., O'Mahony, D., Van Sinderen, D., Wallace, M., Brennan, L., Stanton, C., Marchesi, J.R., Fitzgerald, A.P., Shanahan, F., Hill, C., Ross, R.P. & O'Toole, P.W. (2012) Gut Microbiota composition correlates with diet and health in the elderly. Nature, 488, 178–84.
5. O'Sullivan, Ó., Coakley, M., Lakshminarayanan, B., Claesson, M.J., Stanton, C., O'Toole, P.W. and Ross, R.P. (2011) Correlation of rRNA gene amplicon pyrosequencing and bacterial culture for microbial compositional analysis of faecal samples from elderly Irish subjects. J. Appl. Microbiol. 111(2):467–73.

Technology

PROFILE

Dr. Paul Cotter

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Education

1996 B.Sc. (Hons) 1st class Microbiology, University College Cork (UCC), Ireland (Graduated in 1st position)

2001 Ph.D. Molecular Biology, University College Cork (UCC), Ireland

Career

2009 Principal Research Officer, Teagasc Food Research Centre

2009 Manager of Teagasc Next Gen DNA Sequencing platform

2009 PI, APC Microbiome Institute

2007–09 Lecturer Microbiology Dept., UCC

2002–06 Post-Doc/Senior Research Fellow UCC

Expertise

- Microbiology of foods and the role of microbes in health, spoilage and disease.
- Microbiology of the gut and its modulation by diet and exercise.
- Food grade antimicrobials to control spoilage and pathogenic bacteria.
- Next generation DNA sequencing technologies.
- Spore-forming bacteria; control and testing.

Selected Publications (of >200)

1. Quigley L, O'Sullivan DJ, Daly D, O'Sullivan O, Burdikova Z, Vana R, Beresford TP, Ross RP, Fitzgerald GF, McSweeney PLH, Giblin L, Sheehan JJ, Cotter PD. 2016. Thermus and the pink discoloration defect in cheese. mSystems 1:e00023–16
2. Clarke, S.F., E.F. Murphy, O. O'Sullivan, A.J. Lucey, M. Humphreys, A. Hogan, P. Hayes, M. O'Reilly, I.B Jeffery, R. Wood-Martin, D.M. Kerins, E. Quigley, R.P. Ross, P.W. O'Toole, M.P. Molloy, E. Falvey, F. Shanahan and P.D. Cotter. 2014. Exercise and associated dietary extremes impact on gut microbial diversity. Gut. 63:1913–20
3. O'Sullivan, D., P.D. Cotter, O. O'Sullivan, L. Giblin, P. McSweeney and J.J. Sheehan. 2015. Temporal and spatial differences in microbial composition during the manufacture of a Continental-type cheese. Appl Environ Microbiol. 81:2525–33.
4. Field, D., N. Gaudin, F. Lyons, P.M. O'Connor, P.D. Cotter, C. Hill and R.P. Ross. 2015. A bioengineered nisin derivative to control biofilms of Staphylococcus pseudintermedius. PLoS One 10:e0119684.
5. Walsh, C.J., C.M. Guinane, P.W. O'Toole and P.D. Cotter. 2014. Beneficial modulation of the gut microbiota. FEBS Letts Epub. doi: 10.1016/j. febslet.2014.03.035
6. Doyle, C.J., D. Gleeson, K. Jordan, T.P. Beresford, R.P. Ross, G.F. Fitzgerald and P.D Cotter. 2014. Clostridia and their significance with respect to milk and dairy products. Int J Food Microbiol. 197:77–87.

Technology

PROFILE

Dr. Fiona Crispie

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Education

BA Nat. Sci. Trinity College Dublin

Ph.D. Microbiology University College, Cork.

Career

2001–2002: Post-Doctoral Researcher, University College Cork.

2002–2006: Post-Doctoral Researcher, University College Cork/Teagasc.

2006–2009: Research Officer, Teagasc.

2009–Present: Senior Post-Doctoral Researcher, Next Generation Sequencing Platform, APC (Teagasc).

Expertise

- Next generation DNA sequencing technologies.
- Microbiology of the gut.
- Antimicrobials to control spoilage and pathogenic bacteria.

Selected Publications

1. Pusceddu MM, El Aidy S, Crispie F, O'Sullivan O, Cotter P, Stanton C, Kelly P, Cryan JF, Dinan TG. 2015. N-3 Polyunsaturated Fatty Acids (PUFAs) Reverse the Impact of Early-Life Stress on the Gut Microbiota. *PLoS One*. 10(10):e013972.
2. Golubeva AV, Crampton S, Desbonnet L, Edge D, O'Sullivan O, Lomasney KW, Zhdanov AV, Crispie F, Moloney RD, Borre YE, Cotter PD, Hyland NP, O'Halloran KD, Dinan TG, O'Keeffe GW, Cryan JF. 2015. Prenatal stress-induced alterations in major physiological systems correlate with gut microbiota composition in adulthood. *Psychoneuroendocrinology*. 60:58–74.
3. Desbonnet L, Clarke G, Traplin A, O'Sullivan O, Crispie F, Moloney RD, Cotter PD, Dinan TG, Cryan JF. 2015. Gut microbiota depletion from early adolescence in mice: Implications for brain and behaviour. *Brain Behav Immun*. 48:165–73.
4. Davey KJ, Cotter PD, O'Sullivan O, Crispie F, Dinan TG, Cryan JF, O'Mahony SM. 2013. Antipsychotics and the gut microbiome: olanzapine-induced metabolic dysfunction is attenuated by antibiotic administration in the rat. *Transl Psychiatry* 1;3:e309.
5. Dobson A, Crispie F, Rea MC, O'Sullivan O, Casey PG, Lawlor PG, Cotter PD, Ross P, Gardiner GE, Hill C. 2011. Fate and efficacy of lacticin 3147-producing *Lactococcus lact*is in the mammalian gastrointestinal tract. *FEMS Microbiol Ecol*. 76(3) 602–14.
6. Rea MC, Dobson A, O'Sullivan O, Crispie F, Fouhy F, Cotter PD, Shanahan F, Kiely B, Hill C, Ross RP. 2011.
7. Effect of broad – and narrow-spectrum antimicrobials on *Clostridium difficile* and microbial diversity in a model of the distal colon. *Proc Natl Acad Sci U S A*. 108(1):4639–44.

Technology

PROFILE

Dr. Emily Crofton

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Education

Ph.D. in Sensory and Consumer Science, University College Dublin (2009–2013).

Postgraduate Diploma in Education (PGDE), NUI Maynooth (2007–2008).

B.Sc. in Food Science, University College Dublin (2003–2007).

Career

2014–Present: Manager – Sensory Food Network Ireland, Teagasc Research Centre, Ashtown, Dublin 15.

Sep–Dec 2014: Online Tutor for the Principles of Sensory Science module as part of the M.Sc. in Food, Nutrition and Health, University College Dublin.

2009–2010: Sensory Analysis Lecturer, UCD Institute of Food and Health, University College Dublin.

2007–2008: Secondary School Teacher in Biology and Science, St. Joseph's Secondary School, Dublin 7.

Expertise

Dr. Crofton's expertise lies in the area of sensory and consumer science. Her Ph.D. was part of a large FIRM-funded project, in which her research focused on the consumer-led development of healthy snack foods containing brewers spent grain for the Irish market. She has extensive experience in applying a range of sensory evaluation techniques for both product development and quality control applications, in addition to using both qualitative and quantitative research methods to study consumer behaviour. She also has a wide range of teaching experiences having designed and delivered sensory analysis courses within an academic and industry setting. Her interests lie broadly in ultilising sensory and consumer methods to enhance the product development process. She also has a keen interest in understanding how interactions between the human senses impact our eating and drinking experiences. Dr. Crofton joined Teagasc in 2014 where is she responsible for co-ordinating the development of Sensory Food Network Ireland.

Publications

1. Crofton, E.C., Markey, A. and Scannell, A.G.M. (2014). Perceptions of healthy snacking among Irish adolescents: A qualitative investigation. *International Journal of Health Promotion and Education*, 52: 188–199.
2. Crofton, E.C., Markey, A. and Scannell, A.G.M. (2013). Consumers' expectations and needs towards healthy cereal based snacks: An exploratory study among Irish adults. *British Food Journal*, 115: 1130–1148.
3. Ktenioudaki, A., Crofton, E., Scannell, A.G.M., Hannon, J.A., Kilcawley, K.N. and Gallagher, E. (2013). Sensory properties and aromatic composition of baked snacks containing brewer's spent grain. *Journal of Cereal Science*, 57 (3): 384–390.

Technology

PROFILE

Pat Daly

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Education

Honours Degree in Chemistry and M.Sc., Food Science.

Career

He is a Principal Research Officer and Head of Food Industry Development at Teagasc, the Irish Agriculture and Food Development Authority.

Expertise

He has worked with Teagasc since 1988 where he leads the Teagasc Food Industry Development programme. He leads a team of scientists and technologists providing technology development support for the food processing sector through product development supports, training programmes, scientific seminars, consultancy services, food market research and technical information service. The work programme operates from two Teagasc Food Research Centres, Ashtown, Dublin and Moorepark, Co. Cork. The team also support food research knowledge and technology transfer to industry through training courses, seminars, consultancy work and R&D supports. A wide range of expertise, pilot scale processing facilities and product testing services are available to industry for business start-up, new product development and innovation supports. A focus of the work programme is supporting small and medium sized (SME) enterprises and start-up food businesses. This work is carried out in conjunction with Enterprise Ireland and other national and regional food development agencies. Previously he worked as a technical consultant and trainer in the food industry and other sectors with the Irish Institute for Industrial Research and Standards. He has over twenty years experience working with the food processing sector as a trainer and consultant, specialising in the area of food safety and quality management systems. During this time he worked with a large number of leading international food manufacturing companies with production operations in Ireland and also with the many SMEs throughout the country. He has also carried out several projects for Government Departments and other state agencies. He has participated in EU food research projects, international assignments and study visits in relation to the food processing sector. He has represented Teagasc on many national food technical committees and contributed to the development of a number of national policy documents and standards for the food sector.

Technology

PROFILE

Dr. Martin Danaher

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Education

Ph.D. in Analytical Chemistry, University College Cork 2003.

B.Sc. Industrial Chemistry, University of Limerick, 1997.

Career

2002–Present: Teagasc Food Researcher.

1997–1998: R&D Chemist, Gerard Laboratories.

1998–2002: Ph.D. student – "Teagasc Walsh Fellow."

Expertise

- Analytical chemistry: Chromatographic separations, sample purification, mass spectrometry, biosensors and immunoassays.
- Residue analysis: Agrochemical, environmental, natural toxins and medicinal adulterants.
- Databases: Coordinator of Ireland's "National Food Residue" and "Veterinary Drug and Feed Additive" Databases.
- Exposure and Risk Assessment: Exposure and risk assessment to contaminants from food.

Selected Publications

1. O'Mahony, J., Moloney, M., McConnell, R.I., Benchikh, E.O., Lowry, P., Furey, A., and Danaher. M., (2011). Simultaneous detection of four nitrofuran metabolites in honey using a multiplexing biochip screening assay. *Biosensors and Bioelectronics* 26 (10), pp. 4076–4081.
2. Vinogradova, T., Danaher, M., Baxter, A., Moloney, M., Victory, D. and Haughey, S.A. (2011). Rapid surface plasmon resonance immunobiosensor assay for microcystin toxins in blue-green algae food supplements. *Talanta*, 84 (3), pp. 638–643.
3. Whelan, M., Kinsella, B., Furey, A., Moloney, M., Cantwell, H., Lehotay, S.J. and Danaher, M. (2010). Determination of anthelmintic drug residues in milk using ultra high performance liquid chromatography-tandem mass spectrometry with rapid polarity switching *Journal of Chromatography A,* 1217 (27), pp. 4612–4622.
4. Kinsella, B., Lehotay, S.J., Mastovske, K., Lightfield, A.R. and Danaher, M. (2009). New method for the analysis of flukicide and other anthelmintic residues in bovine milk and liver using liquid chromatography-tandem mass spectrometry. Analytica Chimica Acta, 637(1–2), pp. 196–207.
5. Kinsella, B., O'Mahony, J., Malone, E., Moloney, M., Cantwell, H., Furey, A. and Danaher, M. (2009). Current trends in sample preparation for growth promoter and veterinary drug residue analysis. Journal of Chromatography A, 1216(46), pp. 7977–8015.

Technology

PROFILE

Dr. Liana Drummond

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Education

B.Sc. University of Rio de Janeiro, Brazil. 1991

M.Sc. South Bank University, London, UK. 1997

Ph.D. University College Dublin, Ireland. 2008

Career

1991–1992: Project Engineer, Rio de Janeiro, Brazil

2001–2002: Research Assistant – Delft University of Technology, The Netherlands

2010–2012: Post Doctoral Research Scientist, FP7 – COOLMEAT Project, University College Dublin

2012–2014: Post Doctoral Research Scientist, FP7 – MILDDRY Project, University College Dublin

2014–Present: Research Officer, Food Chemistry and Technology Department

Expertise

My research interests relate to food processing in general and meat products in particular. I hold a B.Sc. in Chemical Engineering and an M.Sc. Food Safety and Control. Previous research work included the development of a rapid cooling technology for cooked meat products and the applications of microwave-vacuum drying to heat sensitive food ingredients. Currently a Project Manager for ReValueProtein project which aims to establish and optimise protocols to extract, characterise and test proteins and peptides from beef and pork fifth quarter products. The project brings together a multidisciplinary team to generate technical know-how, develop and optimize processing conditions for protein extraction, followed by isolation, characterisation and investigation of various applications in food, beverage, health and biomedical engineering.

Selected Publications

1. Drummond, L., Mullen, A.M., Garcia, C., and Lynch, S. (2015) Adding value to meat processing. *TResearch Magazine*, Spring 2015, (2015): 30–31.
2. Drummond, L., Meinert, L., Koch, A.G., Wurtz J., Zhang, Z. and Sun, D.-W. (2015) Safety and quality evaluation of large meat joints cooled by a pre-commercial immersion vacuum cooling prototype. *International Journal of Food Science & Technology* 50(9), 2066–2073.
3. Zhang, Z., Drummond, L. and Sun, D.-W. (2013). Vacuum cooling in bulk of beef pieces of different sizes and shape – Evaluation and comparison to conventional cooling methods. *Journal of Food Engineering* 116 (2) 581–587.
4. Drummond, L. and Sun, D.-W. (2012) Evaluation of the immersion vacuum cooling of cooked beef joints – mathematical simulation of variations in beef size and porosity and pressure reduction rates. *Innovative Food Science and Emerging Technologies* 16, 205–210.
5. Drummond, L., Sun, D.-W., Vila, C.T. and Scannell, A.G.M. (2009). Application of immersion vacuum cooling to water-cooked beef joints – quality and safety assessment. *LWT – Food Science and Technology* 42(1), 332–337.
6. Drummond, L. and Sun, D.-W. (2008). Temperature evolution and mass losses during immersion vacuum cooling of cooked beef joints – a finite difference model. *Meat Science* 80(3), 885–891.

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Technology

PROFILE

Dr. Geraldine Duffy

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Education

Ph.D. on "Development of rapid methods for the isolation and detection of *Listeria monocytogenes* from meat" University of Ulster, Jordanstown, N.I. (1994)

Bachelor of Science Degree, University College Dublin, Belfield, Dublin 4.

Career

Head of Food Safety, Teagasc, Food Research Centre, Ashtown, Dublin (2005 to present)

Principal Research Officer, Teagasc Food Research Centre, Ashtown, Dublin

OECD Postdoctoral fellowship, Eastern Regional Research Centre, Agricultural

Research Service, U.S.D.A., Philadelphia (1996)

Post Doctoral Fellowship at University of Nottingham and Unilever, UK (1994)

EU training fellowship, TNO, The Netherlands Organisation for Applied and Scientific Research (1993)

Expertise

Research focuses on transmission, behaviour and control of microbial pathogens, in particular verocytotoxigenic *E. coli*, *Salmonella* and *Campylobacter* along the farm to fork chain. The research is applied to the development of food safety management systems including quantitative risk assessment models and novel interventions for control of known and emergent food borne pathogens. She has published widely in the field of microbial food safety with over 100 publications including books and book chapters. Dr. Duffy has considerable experience in the co-ordination of national and international research programmes and under the European Commission Framework Research Programme she has co-ordinated a 41 partner multi-national European Union Framework integrated research project on beef safety and quality (*Prosafebeef*). She is member of a number of professional committees including the Scientific Committee of the Food Safety Authority of Ireland and has served as a food safety expert for the European Food Safety Authority (EFSA) W.H.O / FAO and I.L.S.I. (International Life Science Institute).

Selected Publications

1. Burns AM, Duffy G, Walsh D., Tiwari, B, Grant, J., Lawlor, P.G., and Gardiner GE, (2016). Survival characteristics of monophasic Salmonella Typhimurium 4,[5],12:i:- strains derived from pig feed ingredients and compound feed. *Food Control* 64, 105–114.
2. Lawal, D., Burgess, C., McCabe, E., Whyte, P. and Duffy, G. (2015). Development of a quantitative real time PCR assay to detect and enumerate Escherichia coli O157 and O26 serogroups in bovine recto-anal swabs J. Micro methods 114:9–15.
3. O'Leary, D., McCabe, E.M., McCusker, M.P., Martins, M., Fanning, S. and Duffy, G. (2015). Acid environments affect biofilm formation and gene expression in isolates of Salmonella enterica Typhimurium DT104. Int J Food Microbiol. 3; 206: 7–16
4. Thomas, K.M., McCann, M., Collery, M.M, Logan, A., Whyte, P., McDowell, D.A. and Duffy, G, (2013). Transfer of Verocytotoxigenic Escherichia coli O157, O26, O111, O103 and O145 from Fleece to Carcass during Sheep Slaughter in an Irish export abattoir. Food Micro. 34 (1) 38–45.
5. Thomas, K.M., McCann, M., Collery, M.M, Logan, A., Whyte, P., McDowell, D.A. and Duffy, G, (2012). Tracking Verocytotoxigenic Escherichia coli O157, O26, O111, O103 and O145 in Irish Cattle at slaughter. Int J. Food Micro 153(3):288–96

Technology

PROFILE

Dr. Michael Gaffney

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Education

B.Sc. National University of Ireland, Maynooth, 2002

Ph.D. University College Dublin, Ireland. 2012

Career

2002–2006: Ph.D. Candidate, Department of Environmental Resource Management, UCD

2006: Research Assistant, Department of Biological Sciences, University of Wales, Swansea, Wales

2006–2013: Protected Crops Specialist, Horticulture Development Department, Teagasc

2013–2016: Research Officer, Horticulture Development Department, Crops, Env & Land Use Programme, Teagasc

2016–Present: Senior Research Officer, Horticulture Development Department, Crops, Environment & Land Use Programme, Teagasc

Expertise

My primary research interests relate to aspects of vegetable and fruit agronomy, in particular, the influence and impact of agronomic practices on the phytochemical content and quality of edible crops, including the impact of variety selection, fertilisation strategy and crop protection inputs. Phytochemical content can vary greatly depending on variety selection alone, as we have demonstrated for Broccoli, Onion, Carrot, Strawberry and Rocket among others to date. The value and reuse of fruit and vegetable processing waste, either as a food additive or extraction material is also an interest of mine as is the fate of phytochemical's through the food production process. I am also interested in the impact phytochemical's have on insect pests and if increasing the concentration of phytochemical's in a plant, either by variety selection or application of bio stimulants, can suppress the damaging impact of crop pests. A particular focus of my work has been the use of such plant extracts as plant protection products, including the use of plant extracts to suppress insect pest populations. In addition, I am interested in most aspects of horticultural food production.

Selected Publications

1. Reilly, K., Valverde., Finn, L., Gaffney, M., Rai, D & Brunton, N. (2015) A note of the feasibility of selenium supplementation of Irish grown Allium crops. *Irish Journal of Agricultural and Food Research*. 53(1): 91–99
2. Valcarel, J., Reilly, K., Gaffney, M & O'Brien, N (2015) Total carotenoids and acorbic acid content in sixty varieties of potato (Solanum tuberosum L.) grown in Ireland. *Potato Research*. DOI:10.1007/s11540–014–9270–4
3. Valverde, J., Reilly, K., Villacreces, S., Gaffney, M., Grant, J & Brunton, N. (2014) Variation in bioactive content in broccoli (Brassica oleracea var. italic) grown under conventional and organic production systems. *Journal of the Science of Food and Agriculture*. DOI: 10.1002/jsfa.6804
4. Tiwari, U., Sheehy, E., Rai, D., Gaffney, M., Evans. &Cummins, E. (2015) Quantative human exposure model to assess the level of glucosinolates upon thermal processing of cruciferous vegetables. *Food Science and Technology* Vol 63, p253–261.
5. Lola-Luz, T., Hennequart, F. & Gaffney, M.T. (2013) Enhancement of phenolic and flavonoid compounds in cabbage (Brassica oleraceae) following application of commercial seaweed extracts of the brown seaweed (Ascophyllum nodosum) Agricultural and Food Science Vol 22, p288–295.
6. Reilly, K., Valverde, J. , Finn, L., Brunton, N., Sorensen, J., Sorensen, H., Grant, J., and Gaffney, M. (2013) Potential of cultivar and crop management to optimise phytochemical content in winter-grown sprouting broccoli (Brassica oleracea L. var. italica). *Journal of the Science of Food and Agriculture*.

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Technology

PROFILE

Dr. Eimear Gallagher

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Education

Ph.D. University College Cork (2005)

M.Sc. University College Cork (2000)

B.Sc. University College Cork (1997)

Career

2000–Present: Senior Research Officer, Teagasc Research Centre, Ashtown, Dublin 15.

1999–2000: Research Scientist, Scientific Support team, Nestlé PTC, York, YO1 1XY, England. (7 month contract).

1997–1997: Research Assistant, Dept. of Food and Nutritional Sciences, National University of Ireland, Cork.

Expertise

Dr. Gallagher's expertise lies predominantly in cereal and bakery research. She has extensive experience in grain milling, empirical dough rheology, confocal and scanning microscopy, digital imaging and sensory analysis. She has developed a particular capability in the gluten-free area, where she has conducted research in product reengineering, instrumental texture analysis, fundamental rheology and nutritional profiling. She is also a coordinator of Sensory Food Network Ireland, a national network of excellence in sensory food science. As well as conducting publicly funded research, Dr. Gallagher also has a number of confidential, industry-led short-term projects

Selected Publications

1. O'Shea, N., Kilcawley, K. and Gallagher, E. (2016). Influence of α-amylase and xylanase on the chemical, physical and volatile compound properties of wheat bread supplemented with wholegrain barley flour. European Food Research and Technology DOI: 10.1007/s00217–016–2651-y.
2. Ktenioudaki, A., Alvarez, L., Kilcawley, K., Gallagher, E. (2015). Application of bioprocessing techniques (sourdough fermentation and technological aids) for brewer's spent grain breads. Invited paper for the special issue of Food Research International, doi:10.1016/j.foodres.2015.03.008.
3. O'Shea, N., Ktenioudaki, A., Smyth, T.P., McLoughlin, P., Doran, L., Auty, M., Arendt, E.K. and Gallagher, E. (2015). Physicochemical assessment of two fruit by-products as functional ingredients: Apple and orange pomace. *Journal of Food Engineering*, 153: 89–95.
4. Ktenioudaki, A., Alvarez-Jubete, L. and Gallagher, E. (2015). A review of the process-induced changes in the phytochemical content of cereal grains: The breadmaking process. Critical Reviews in Food Science and Nutrition. 55(5):611–9.
5. Ktenioudaki, A., Crofton, E., Scannell, A.G.M., Hannon, J.A., Kilcawley, K.N. and Gallagher, E. (2013). Sensory properties and aromatic composition of baked snacks containing brewer's spent grain. Journal of Cereal Science, 57 (3): 384–390.

Technology

PROFILE

Dr. Linda Giblin

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Education

1989 B.Sc. Biotechnology, Dublin City University, Dublin, Ireland

1995 Ph.D. Microbiology Dept., University College Cork, Cork, Ireland

Career

2002–Present: Senior Researcher Teagasc Food Research Centre, Moorepark, Fermoy, Cork, Ireland.

1999–2002: Research/Senior Scientist R&D, XANTHON Inc. (start-up biotech company), Research Triangle Park, North Carolina, U.S.A.

1997–1999: Post-doctoral Scientist, Institute of Molecular BioSciences, Massey University, New Zealand.

1994–1997: Wellcome Post-doctoral Research Scientist, Biochemistry Dept., U.C.C, Cork, Ireland.

Expertise

- Life stage Nutrition: Designing foods for pregnant women and their child.
- Foods for weight management.
- Food Bioavailability & Bioaccessibility.
- Food Bioactives.
- Genotype-phenotype interactions.
- Large animal trials: Bovine mammary challenge studies, Porcine post-prandial studies, Porcine models for Infant programming.
- Bovine DNA depository.

Selected Publications

1. Giblin, L., C. Darimont, P. Leone, L.B. McNamara, F. Blancher, D. Berry, E. Castaneda-Gutierrez, and P.G. Lawlor. 2015. Offspring subcutaneous adipose markers are sensitive to the timing of maternal gestational weight gain. Reprod Biol Endocrinol. 13(1):16.
2. O'Sullivan, D.J., P.D. Cotter, O. O'Sullivan, L. Giblin, P.L. McSweeney, J.J. Sheehan. 2015. Temporal and spatial differences in microbial composition during the manufacture of a continental-type cheese. Appl Environ Microbiol.;81(7):2525–33.
3. H. Schellekens, P.N. De Francesco, D. Kandil, W.F. Theeuwes, T. McCarthy, W.E. van Oeffelen, M. Perello, L. Giblin, T. G. Dinan and J. F. Cryan. 2015 (in press). Ghrelin's Orexigenic Effect Is Modulated via a Serotonin 2C Receptor Interaction. ACS Chem Neurosci. 2015.
4. Amdi,C., L. Giblin, T. Ryan, N.C. Stickland and P.G. Lawlor, 2014. Maternal backfat depth in gestating sows has a greater influence on offspring growth and carcass lean yield than maternal feed allocation during gestation. Animal 8(2):236–44.
5. Le Maux, S., A. Brodkorb, T. Croguennec, A. A. Hennessy, S. Bouhallab, and L. Giblin. 2013. beta-Lactoglobulin-linoleate complexes: In vitro digestion and the role of protein in fatty acid uptake. J Dairy Sci 96:4258–68.
6. Hand, K. V., C. M. Bruen, F. O'Halloran, H. Panwar, D. Calderwood, L. Giblin, and B. D. Green. 2013. Examining acute and chronic effects of short – and long-chain fatty acids on peptide YY (PYY) gene expression, cellular storage and secretion in STC-1 cells. Eur J Nutr 52:1303–13.
7. Beecher, C., M. Daly, R. P. Ross, J. Flynn, T. V. McCarthy, and L. Giblin. 2012. Characterization of the bovine innate immune response in milk somatic cells following intramammary infection with Streptococcus dysgalactiae subspecies dysgalactiae. J Dairy Sci 95:5720–9.

Technology

PROFILE

Prof. TP Guinee

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Education/Career

Professor Timothy P. Guinee is a Principal Research Officer in Food Chemistry and Technology at Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork, Ireland. He graduated with a B.Sc. in Dairy Science (1980) and a Ph.D. in Dairy Chemistry (1985) from University College Cork. He was employed as a lecturer in Food- and Environmental- sciences at Sligo Regional Technical College between 1984–1986. From 1986 to 1990, he worked in commercial R&D, as a Senior Researcher Scientist in Ireland, Germany and US on various aspects of cheeses (natural, processed, analogue types) and applications of milk protein ingredients in cheese and fermented milk products. He was appointed as a Senior Research Officer in Teagasc in 1990 and was promoted to Principal Research Officer in 2000.

Expertise

His particular interests include the study of the rheology and functional properties (e.g., viscosity, gelation, texture, heating behaviour) of composite high protein food matrices, and the exploitation of these properties in food manufacture and assembly/formulation, with particular emphasis on gels and cheese-based systems. He has investigated the influences of various factors on the properties of cheeses, including milk composition/ treatments, gelation conditions, processing treatments, added ingredients, cheese composition and maturation conditions. A key aspect of his research involves the optimization of protein-protein, protein-mineral and protein-water interactions for the control of structure-functional relationships of foods, such as texture and heat stability. This approach has been applied in the development of reduced-fat cheese and a new cheese technology platform (based on gelation of reassembled milks). He has been an editorial board member for *International Dairy Journal* (from 2005) and formerly a co-editor. In 2011, he was appointed Adjunct Professor to the College of Science, Engineering and Food Science, University College Cork.

Selected Publications

1. Guinee, T.P. (2016). Protein in cheese products: structure-function relationships. In P.L.H. McSweeney and S.A. O'Mahony (Eds), Advanced Dairy Chemistry, Vol. 1 B Proteins: Applied Aspects (4th ed.) Springer Science+Business Media, New York, 347–415.
2. Guinee, T.P. and O'Callaghan D.J. (2013). Effect of increasing the protein-to-fat ratio and reducing fat content on the chemical and physical properties of processed cheese product. *J. Dairy Sci.* 6830–6839.
3. Guinee, T.P., Pudja, P., Miočinović, J., Wiley, J., & Mullins, C.M. (2015). Textural and cooking properties and viscoelastic changes on heating and cooling of Balkan cheeses. *Journal of Dairy Science*, 98, 7573–7586.
4. Henneberry, S., Kelly, P.M., Kilcawley, K.N., Wilkinson, M.G., Guinee, T.P. (2015). Interactive effects of salt and fat reduction on composition, rheology and functional properties of Mozzarella-style cheese. *Dairy Science and Technology*, 95, 613–638.
5. Henneberry, S., O'Sullivan, M. G., Kilcawley, K. N., Kelly, P. M., Wilkinson, M. G., & Guinee, T. P. (2016). Sensory quality of unheated and heated Mozzarella-style cheeses with different fat, salt and calcium levels. *International Journal of Dairy Technology*, 69, 38–50.
6. Hickey, D.K., Guinee T.P., Hou, J., and Wilkinson M.G. (2013). Effects of variation in cheese composition and maturation on water activity in Cheddar cheese during ripening. *Int. Dairy J.* 30, 53–58.
7. Hou, J., Hannon, J.A., McSweeney, P.L.H., Beresford, T.P. and Guinee, T.P. (2012). Effect of curd washing on composition, lactose metabolism, pH, and the growth of non-starter lactic acid bacteria in full fat Cheddar cheese. *Int. Dairy J.*, 25, 21–28.
8. Hou, J., Hannon, J.A., McSweeney, P.L.H., Beresford, T.P. and Guinee, T.P. (2014). Effect of curd washing on cheese proteolysis, texture, volatile compounds, and sensory grading in full fat Cheddar cheese. *Int. Dairy J.*, 34, 190–198.

Technology

PROFILE

Carol Griffin

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Education

M.Sc. (Agr.) Degree in Food Science & Technology UCD 1993.

Graduate Diploma in Food Science & Technology (IFST, UK) DIT, Kevin St. 1991.

B.Sc. (Biochemistry, Physiology, Human Nutrition) NUI, Galway 1989.

Career

Jan 2010–Present: Food Industry Support (NPD & Sensory Analysis) – Teagasc, Food Research Centre, Ashtown.

Jan 2008–Jan 2010: Artisan Meat Technologist – Teagasc, Food Research Centre, Ashtown.

Feb 2002–Jan 2008: Food Safety Consultant & Trainer, Teagasc, Food Research Centre, Ashtown.

Sep 2000–Feb 2002: Food Safety Consultant with Verner Wheelock Associates (VWA).

Jan 1999–Sep 2000: Food Safety Consultant (self employed).

Mar 1994–Dec 1998: Quality Assurance Manager Goldstar Meats (renamed Kepak, Glasnevin).

Jun 1992–Mar 1994: Quality Technician – Batchelors Ltd. Bannow Road, Cabra, Dublin 7.

Expertise

Areas of expertise include:
Working as part of the Food Industry Development Department to support food businesses through advice, consultancy, auditing and training, in the areas of sensory analysis, product development, innovation, food safety, labelling and food business technical process development.

Consultancy projects undertaken include:

- Product reformulations, new product development from concept to production trials, sensory analysis of a wide range of food products for food businesses and to support the research programme in Teagasc. A major proportion of product and process development projects undertaken focus on shelf life extensions through product, process and packaging re-design.
- Development, delivery, piloting and validation of certified training programmes for all sectors of the food industry to meet client's customer & legislative requirements (topics include product & process development, food legislation, food labelling, hygiene, food safety, HACCP, plant design & food assurance standards, NPD and sensory).
- Descriptive Sensory Panel set up and training.
- Management of the Sensory Analysis Unit in Ashtown.
- Implementation of quality assurance and food safety management systems in a wide range of food businesses.
- Providing a technical advisory service to the meat & speciality food sector through mentoring, training and consultancy in the areas of food product and process development, food safety management systems and regulatory compliance.

Technology

PROFILE

Dr. Ruth Hamill

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Education

Ph.D. (Population Genetics), School of Biology and Environmental Science, UCD

B.Sc. (Zoology, 1H1), School of Biology and Environmental Science, UCD

Experience

2006–Present: Research Officer, Muscle Molecular Biology, Teagasc Food Research Centre, Ashtown

2002–2005: Post-doctoral Research Fellow, Population Genetics, University of St Andrews, Scotland

Expertise

My expertise focuses on muscle biology and meat science with a view to increasing understanding of the biological processes underpinning meat quality, the development of biological (genomic) markers of quality and understanding the structure/function relationship in meat products. My research programme is collaborative and nationally (FIRM/RSF) and European (FP7/COST) funded and I have also worked on confidential industry projects. I am currently a collaborator on a number of active projects in the healthier meat products area (e.g. Prosslow) and I am PI and Co-ordinator of a FIRM-funded project (Meat4Vitality) focused on developing novel meat products targeting the specific nutritional needs of older people and I previously co-ordinated a project (MeatMatrix) in this area focused on applying spectroscopic, microscopy, calorimetric and rheology techniques in model meat and myofibrillar systems to enhance understanding of the molecular mechanisms underpinning technological and sensorial quality. Through these projects the aim is to help facilitate the adoption of a more knowledge-based approach to the generation of targeted food systems and novel meat products delivering desired characteristics.

Selected Publications

1. Keenan, D. F., Resconi, V. C., Smyth, T. J., Lefranc, C., Botinestean, C., Kerry, J. P., Hamill, R. M. (2015). The effect of partial-fat substitutions with encapsulated and unencapsulated fish oils on the technological and eating quality of beef burgers over storage. Meat Science, available online, doi:10.1016/j.meatsci.2015.04.013
2. Tobin, B. D., M. G. O'Sullivan, R. Hamill and J. P. Kerry (2014). European consumer attitudes on the associated health benefits of neutraceutical-containing processed meats using Co-enzyme Q10 as a sample functional ingredient. Meat Science 97(2): 207–213.
3. Keenan, D. F., Auty, M. A. E., Doran, L., Kerry, J.P., Hamill, R. M. (2014). Investigating the influence of inulin as a fat substitute in comminuted products using rheology, calorimetric and microscopy techniques. Food Structure, 01: 2014
4. Hamill, RM, Aslan, O, Mullen, AM, O'Doherty, JV, McBryan, J, Morris, DG and Sweeney, T (2013). Transcriptome analysis of porcine *M. semimembranosus* divergent in intramuscular fat as a consequence of dietary protein restriction. BMC Genomics.2013, 14:453
5. McArdle, R, Hamill, R.M. and Kerry, J.P. (2011). Utilisation of hydrocolloids in processed meat systems. In: Processed meats: improving safety, nutrition and quality, p. 243–269. Edited by J.P. Kerry and J.F. Kerry, Woodhead Publishing.

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Technology

PROFILE

Dr. Maria Hayes

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Education

B.Sc. University College Dublin, Ireland. 2002
Ph.D. University College Cork, Ireland. 2007
Leadership Development Diploma. 2016

Career

May 2016–July 2016: Guest researcher at Chalmers University of Technology, The Biology and Biological Engineering Unit, Gothenburg, Sweden.

February–March 2015: Hosted researcher at NMBU, Oslo, Norway.

October 2008–Present: Natural Products Chemist, Teagasc Food Research Centre, Ashtown, Dublin 15

October 2008–Present: Guest lecturer Dublin Institute of Technology module TFFP3055 Nutraceutical Product development.

June 2007–October 2008: Researcher at the Centre of Applied Marine Biotechnology, Letterkenny Institute of Technology, Donegal, Ireland.

December 2006–June 2007: Researcher at Teagasc Moorepark Biotechnology Centre and University College Cork.

Expertise

- High quality scientific research skills.
- Novel proteins from marine, meat and cereal sources – WP leader on NutraMara, ReValueProtein and NutriCereals Ireland.
- Isolation and characterization of techno-functional and health ingredients.
- Project management/evaluation.
- Technology & knowledge transfer.
- Innovation and new product development.
- Bioassay development – Heart health, renin, PAF-AH, ACE-I inhibitory, diabetes, mental health, antimicrobial PEP inhibitory, anti-oxidative, opioid.
- Allergenicity – member of EU COST Action ImPARAS EU FA1402
- Seaweed and microalgae – member of EU COST Action EU ALGAE EU 1408
- Event organization and moderation (conferences & workshops)
- Book editor and writer.

Selected Publications

1. Lafarga, T., & Hayes, M. (2016), Meat-derived bioactive protein hydrolysates and peptides as food ingredients: overcoming current challenges. Food Reviews international, DOI: http://dx.doi.org/10.1080/87559129.2016.1175013.
2. Dave, L. A., Hayes, M., Mora, L., Montoya, C. A., Moughan, P. J., Rutherfurd, S. M. (2016), Gastrointestinal endogenous protein-derived bioactive peptides: An in vitro study of their gut modulatory potential. International Journal of Molecular Sciences, 17, 482; doi:10.3390/ijms17040482.
3. Dave, L. A., Hayes, M., Montoya, C. A., Rutherfurd, S. M., Moughan, P. (2016), Human gut endogenous proteins as a source of angiotensin-I-converting enzyme (ACE-I), renin inhibitory and antioxidant peptides. Peptides, 76, 30–44. doi:10.1016/j.peptides.2015.11.003.
4. Dave, L. A., Hayes, M., Moughan, P. J., Rutherfurd, S. M. (2016), Novel Dipeptidyl Peptidase IV inhibitory and antioxidant peptides derived from human gastrointestinal endogenous proteins. Int. J. Pept. Res. Ther. 1–15. DOI 10.1007/s10989–016–9515-y.
5. Gangopadhyay, N., Wynne, K., O'Connor, P. Gallagher, E., Brunton, N. and Hayes, M. (2016), In silico and in vitro analysis of the angiotensin-I-converting enzyme inhibitory activity of hydrolysates generated from crude Barley (Hordeum vulgare) protein concentrates. Food Chemistry, 203, 367–374.

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PROFILE

Dr. Maeve Henchion

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Education

B.Agr.Sc. (Hons, 2.1) 1991, University College Dublin (Awarding Body: NUI).

M.Agr.Sc. (Hons, 1H) 1993, University College Dublin (Awarding Body: NUI).

Ph.D., 1996, University College Dublin (Awarding Body: NUI).

Post Graduate Certificate in Leadership Development (2014) IMI/UCC

Career

Maeve started her research career as a research assistant in University College Dublin during which time she was awarded a Ph.D. for her work on the performance of the Irish beef industry. She took up employment with Teagasc in 1996 on a nationally funded collaborative project that looked at logistics and supply chain management. Since then she has been awarded funding in excess of €3 million from national and EU sources to pursue a range of research interests. These research interests span the supply chain and usually operate at the interface between social science and technical science. They include food innovation, sustainable food production and consumption, consumer and industry acceptance of novel food technologies, food quality and strategic food marketing.

Maeve has published in a wide range of journals given her involvement in many multi-disciplinary projects and she has acted as a referee for Meat Science, Appetite, British Food Journal, *Journal of the Science of Food and Agriculture*, International Journal of Food Science and Technology, Journal of Risk Research and Irish Geography. She was appointed Associate Editor to the editorial board of Nutrition and Food Science in April 2016.

She has developed her leadership and management experience over the years also through appointments within Teagasc, membership of project steering/ advisory committees and formal training. She is currently head of the Department of Agrifood Business and Spatial Analysis which comprises 9 permanent research staff along with associated post-doctoral researchers and post-graduate students.

Expertise

Maeve has significant experience of conducting strategic market research at various points in the chain from farmers through to consumers. She uses qualitative (e.g. focus groups) as well as quantitative (e.g. surveys) research approaches. She has an understanding of food science and supply chain issues and hence can relate research findings to real world contexts. Based on her expertise she can provide advice on strategic marketing, consumer behaviour, innovation management, new product development, market development and food policy.

Selected Publications

1. Henchion, M., McCarthy, M., Resconi, V., Berry, D., and S. McParland (2016) Stakeholder involvement in establishing a milk quality sub-index in dairy cow breeding goals: A Delphi approach, Animal, pp1–14. pii: DOI: 10.1017/S1751731115002165. 10 (5), pp.878–891
2. Handford, C., Dean, M., Henchion, M., Spence, M., Elliott, C. & Campbell, K. (2014). Implications of nanotechnology for the agri-food industry: Opportunities, Benefits and Risks. Trends in Food Science and Technology. Vol. 40, No. 2, 12.2014, p. 226–241
3. Henchion, M., McCarthy, M., Resconi, V. and D. Troy (2014). Meat Consumption: Trends and Quality Matters, Meat Science, 98 (2014), pp. 561–568 DOI information: 10.1016/j.meatsci.2014.06.007
4. Greehy, G. M., McCarthy, M.B., Henchion, M.M., Dillon, E.J, and McCarthy, S.N. (2013). Complexity and conundrums. Citizens' evaluations of potentially contentious novel food technologies using a deliberative discourse approach. Appetite Volume 70, 1 November 2013, pp 37–46
5. Sorenson, D. and Henchion, M. (2011). Understanding consumers' cognitive structures with regard to high pressure processing: a means-end chain application to the chilled ready meals category, Food Quality and Preference Vol. 22(3), Pages 271–280

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PROFILE

Dr. Rita Hickey

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Education

2008 FETAC Level 6 Advanced Certificate in Agriculture.

2003 Ph.D. Microbiology from NUI Cork (UCC).

1998 B.Sc. Hons (1H) from NUI Dublin (UCD).

Career

2007–Present Senior Research Officer, Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork, Ireland.

2005–2007 Process Specialist, Abbott Diagnostics, Sligo.

2004–2005 Research Officer, APC, Teagasc, Ireland.

2003–2004 Postdoctoral Researcher, MFRC, Teagasc, Ireland.

Expertise

- Food oligosaccharides – extraction, enrichment, fractionation and structural analysis for nutraceutical applications.
- Development of bioassays for investigating the bioactive properties of glycans isolated from food sources.
- Manager of tissue culture facilities at Moorepark.
- Electrophoresis including 1D and 2D SDS-PAGE, Western Blotting, protein overproduction, concentration and renaturation.
- Chromotography – Size-exclusion, Affinity and Ion Exchange Chromatography.
- Microbial molecular biology techniques.

Selected Publications

1. Lane, J. A., Kavanaugh, D., Mariño, K., Rudd, P.M. Carrington, S.D., Naughton, J., Clyne, M. and Hickey, R.M. (2012) Anti-infective bovine colostrum oligosaccharides: *Campylobacter jejuni* as a case study. International Journal of Food Microbiology (In press).
2. Lane, J. A., Marino, K., Slattery, H., Carrington, S. D., Rudd, P. M., and Hickey, R.M. (2012) Methodologies for screening of bacteria-carbohydrate interactions: anti-adhesive milk oligosaccharides as a case study. Journal of Microbiological Methods (In press).
3. Hickey, R. (2012). The role of oligosaccharides from human milk and other sources in prevention of pathogen adhesion. *International Dairy Journal*, 22: 141–146.
4. Lane, J.A., Carrington, S.D., Mehra, R.K. and Hickey, R.M. (2011) Screening whole bacterial cell adherence to the human milk oligosaccharide, 2' – fucosyllactose using Surface Plasmon Resonance (SPR) technology.m Analytical Biochemistry. 410, 200–205.
5. Lane, J.A., Mehra, R.K., Carrington, S.D. and Hickey, R.M. (2010). The Food Glycome: a source of protection against chronic infection in the gastro-intestinal tract. International Journal of Food Microbiology, 142; 1–13.
6. Hickey, R. M. (2009). Harnessing Milk Oligosaccharides for nutraceutical applications. In: Dairy-derived ingredients: food and nutraceutical uses. Corredig, M (ed), p308–343.

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PROFILE

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Education

M.Sc. Leibniz University of Hannover, Germany. 2006

Ph.D. Dublin Institute of Technology, Ireland. 2012

Career

2010–January 2016: Department of Food Biosciences, Teagasc.

February 2016–Present: Department of Food Safety, Food Residue Lab, Teagasc.

Expertise

My research focuses primarily on the extraction, enrichment and characterisation of antioxidant, antimicrobial, anti-inflammatory, anticarcinogenic and cholesterol-lowering phytochemicals from plant sources. My research involves utilisation of various novel extraction techniques such as pressurised liquid extraction, ultrasound assisted extraction, pulsed electric field assisted extraction and enzyme assisted extraction for efficient and environmentally friendly extraction of these compounds with a view to valorising the low – or no-value agro-industrial by-products. My expertise includes a range of separation and analytical techniques such as size exclusion, ion exchange, normal phase, reversed phase, hydrophilic interaction liquid chromatography combined with various detection systems such as mass spectrometry, UV-Vis, fluorescence and refractive index. Currently I am involved in methods development and validation for chlorates analysis in dairy products in a laboratory which functions in compliance with ISO 17025:2005 and accredited by Irish National Accreditation Board (INAB).

Selected Publications

1. Hossain, M. B., Rai, D. K., & Brunton, N. P. (2015). Optimisation and validation of ultra-high performance liquid chromatographic-tandem mass spectrometry method for qualitative and quantitative analysis of potato steroidal alkaloids. *Journal of Chromatography B, 997*, 110–115.
2. Hossain, M. B., Aguiló-Aguayo, I., Lyng, J. G., Brunton, N. P., and Rai, D. K. (2015). Effect of pulsed electric field and pulsed light pre-treatment on the extraction of steroidal alkaloids from potato peels. *Innovative Food Science & Emerging Technologies*, *29*, 9–14.
3. Hossain, M. B., Camphuis, G., Aguiló-Aguayo, I., Gangopadhyay, N., and Rai, D. K. (2014). Antioxidant activity guided separation of major polyphenols of marjoram (Origanum majorana L.) using flash chromatography and their identification by liquid chromatography coupled with electrospray ionization tandem mass spectrometry†. *Journal of Separation Science*, *37*(22), 3205–3213.
4. Hossain. M.B., Patras, A., Barry-Ryan. C., Martin-Diana. A.B. and Brunton. N.P. (2011). Application of principal component and hierarchical cluster analysis to classify different spices based on *in-vitro* antioxidant activity and individual polyphenolic antioxidant compounds. *Journal of Functional Foods*, 3, 179–189.
5. Hossain. M.B., Barry-Ryan. C., Martin-Diana. A.B. and Brunton. N.P. (2010). Optimisation of accelerated solvent extraction of antioxidant compounds from rosemary (*Rosmarinus officinalis* L.), marjoram (*Origanum majorana* L.) and oregano (*Origanum vulgare* L.) using response surface methodology. *Food Chemistry,* 126, 339–346.
6. Hossain. M.B., Rai, D.K., Brunton. N.P., Martin-Diana. A.B. and Barry-Ryan. C. (2010). Characterization of phenolics composition in Lamiaceae spices by LC-ESI-MS/MS. *Journal of Agricultural and Food Chemistry*, 58, 10576–10581.
7. Kenny, O. M., McCarthy, C. M., Brunton, N. P., Hossain, M. B., Rai, D. K., Collins, S. G., Jones, P. W., Maguire, A. R., & O'Brien, N. M. (2013). Anti-inflammatory properties of potato glycoalkaloids in stimulated Jurkat and Raw 264.7 mouse macrophages. *Life Sci*, *92*(13), 775–782.

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PROFILE

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Education

B.Sc. (University College Galway).

M.Sc., Ph.D. (University College, Cork).

Teagasc Food Research Centre.

Expertise

Dr. Jordan works on survival and occurrence of foodborne pathogens in dairy products, including *Listeria monocytogenes, S. aureus* and pathogenic *E. coli*, including adaptive tolerance responses and applications of molecular methodology in the study of foodborne pathogens.

Recent research projects funded include:

- Translating fundamental research on Listeria monocytogenes for the benefit of a multi-sectoral ready-to-eat food industry.
- Assuring the safety of mushrooms by the introduction of novel processes to reduce Listeria monocytogenes biofilms and environmental contamination in mushroom production facilities.
- Dairy Processing Technology Centre.
- Milk quality for a changing dairy industry.
- Safe and Healthy Foods.
- Risk assessment in relation to coagulase positive *Staphylococcus aureus*.

Selected Publications

1. Robin Condron, Choreh Farrokh, Kieran Jordan, Peter McClure, Tom Ross and Olivier Cerf. 2015. Guidelines for experimental design protocol and validation procedure for the measurement of heat resistance of microorganisms in milk. International Journal of Food Microbiology 192, 20–25.
2. Kieran Jordan. 2014. Monitoring occurrence and persistence of Listeria monocytogenes in foods and food processing environments in the Republic of Ireland. Frontiers in Microbiology 5, 436.
3. Kieran Jordan, Marion Dalmasso, Juergen Zentek, Anneluise Mader, Geert Bruggeman, JohnWallace, Dario De Medici, Alfonsina Fiore, Estella Prukner-Radovcic, Maja Lukac, Lars Axelsson, Askild Holck, Hanne Ingmer andMindaugas Malakauskas. 2014. Microbes versus microbes: control of pathogens in the food chain. *Journal of the Science of Food and Agriculture*, 94, 3079–3089.
4. Karen Hunt, Francis Butler and Kieran Jordan. 2014. Factors affecting Staphylococcal Enterotoxin C bovine production in milk. *International Dairy Journal* 39, 41–46.
5. David O'Beirne, E. Gleeson, M. Auty and K. Jordan 2014. Effects of processing and storage variables on penetration and survival of Escherichia coli O157:H7 in fresh-cut packaged carrots. *Food Control* 40, 71–77.

Technology

PROFILE

Jim Kelly

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Education

Diploma in Chemical Technology, University College, Cork.

Master in Science Degree, University of Limerick

Expertise

Jim Kelly is responsible for leading the experimental programme on spray drying technology as part of the public research programme and industry-commissioned R&D using the Spray drying facilities at Moorepark Technology Ltd. He has played a key role in the development of dairy powder research in Ireland and has a unique knowledge of the industry coupled with his technical contribution to scientific publications in the area within Teagasc.

His knowledge in spray drying technology is internationally recognised and is widely availed of by fellow researchers and industry clients. In addition, he is highly regarded throughout the Irish /UK Dairy processing sector for plant process efficiency audits that he carries out particularly in process technologies associated with cheese production. He lectures on different dairy technologies, mainly on spray drying and evaporation in the widely regarded training courses presented at Moorepark.

Equipment/Technologies

Powder Technology, Evaporation and Spray Drying, Membrane Separation technologies, Centrifugal Separation technologies. Formulation and Recombination Technologies. Cheese Making Technology at commercial scale. Fermentation and hydrolysis scale up process design, Process Efficiency Auditing.

Selected Publications

1. Kelly, J., Kelly, P.M., Harrington, D. (2002) – Influence of processing variables on the physicochemical properties of spray dried fat-based milk powders – ISSN 0023–7302.
2. Kelly, J, Kelly,P.M (2000) Ingredient development using a Pilot scale Tall form dryer. A database, of process operating conditions and physico-chemical properties of resulting powders. Book of 120 pages.
3. Kelly, J., Kelly, P. Desalination of acid casein whey by nanofiltration. *International Dairy Journal*, Vol. 5 (1995), 227–310.
4. Kelly, J., Kelly, P. Nanofiltration of whey: Quality, environmental and economic aspects. J. of the Soc. Of Dy. Tech., Vol. 48, No. 1, Feb. 1995.
5. Kelly, P.M., Kelly, J., Mehra, R.K., Oldfield, D.J., Raggett, E., O'Kennedy, B.T. (2000). Implementation of integrated membrane processes for pilot scale development of fractionated milk components. Lait 80: 139–153 ISSN 0023–7302.

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PROFILE

Dr. Kieran Kilcawley

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Education

B.Sc. University of Westminster, UK. 1994

Ph.D. University College, Cork, Ireland. 2002.

Career

1990–1996: Research Technician, Imperial Biotechnology Ltd, London, UK

1996–2004: Research Officer, Teagasc Food Research Centre, Moorepark

2004–2008: Senior Research Office

2008–Present: Principle Research Officer

Expertise

My research interests are primarily focused on the impact of volatile compounds on sensory perception of foods and beverages. Most of my experience is directly related to biochemistry and enzymology of foods with a particular emphasis on cheese flavour. I am actively involved in flavour research and in providing a service to industry. The flavour chemistry facility has extensive gas chromatography mass spectrometry capability, including gas chromatography olfactory and uses a range of different automated volatile extraction techniques. I am also a member of the Sensory Food Network Ireland., International Dairy Federation, American Dairy Science Association and Irish Mass Spectrometry Society.

I also have extensive experience in gas chromatography and associated techniques.

I have published >40 peer review research articles and 10 book chapters. I am a member of the editorial board for Dairy Science & Technology (formerly Le Lait) and Journal of Dairy Research. I am a reviewer for a wide number of international peer reviewed journals.

I was actively involved in the organisation of the Eight & Ninth International Cheese Symposia in Cork in 2011 & 2014 in association with the French National Institute for Agricultural Research (INRA) and University College Cork, Ireland (UCC). I was a member of the scientific committee for the IDF Symposia on Cheese in 2016.

Selected Publications

1. O'Callaghan, T.F. Hennessy, D, McAuliffe, S, Kilcawley, K.N, O'Donovan, M, Dillon, P., Ross, R.P, Stanton, C (2016). Effect of pasture versus indoor feeding systems on raw milk composition and quality over an entire lactation. *J. Dairy Sci*, In press
2. Mannion, D.T. Furey, A, Kilcawley, K.N (2016). Comparison and validation of 2 analytical methods for the determination of free fatty acids in dairy products by gas chromatography with flame ionization detection. *J. Dairy Sci*, 99, 5047–5063.
3. Henneberry, S. O'Sullivan, M.G. Kilcawley, K.N. Kelly, P.M. Wilkinson, M.G, Guinee, T.P (2016). Sensory quality of unheated and heated Mozzarella-style cheeses with different fat, salt and calcium levels. *Int. J. Dairy Tec*, 69, 38–50.
4. Rulikowska, A. Kilcawley, K.N, Doolan, I.A. Alonso-Gomez, M. Nongonierma, A.B. Hannon, J.A, Wilkinson, M.G (2013). The impact of reduced sodium chloride content on Cheddar cheese quality. *Int. Dairy J.*, 28, 45–55.
5. Kilcawley, K,N, Nongonierma, A.B, Hannon, J.A, Doolan, I.A, Wilkinson, M.G (2012). Evaluation of commercial enzyme systems to accelerate Cheddar cheese ripening. *Int. Dairy J.* 26, 50–57.
6. Nongonierma, A.B. Abrolova M, Fenelon, M.A, Kilcawley. K.N (2009). Evaluation of two food grade proliposomes to encapsulate an extract of a commercial enzyme preparation by microfluidization *J. Agri. and Food Chem*, 57, 3291–3297.
7. Hickey, D.K, Kilcawley, K.N, Beresford, T.P, Sheehan, E.M, Wilkinson, M.G. (2006) Starter bacteria are the prime agents of lipolysis in Cheddar cheese. *J. Agri. and Food Chem*, 54, 8229–8235.
8. Kilcawley, K.N, Wilkinson, M.G, Fox, P.F. (1998). Review enzyme-modified cheese. *Int. Dairy J.* 8: 1–10.

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PROFILE

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Education

Ph.D. in Food Science and Technology, National University of Ireland, University College Cork, Ireland

M Sc. in Food Technology, Shanghai Ocean University, China

B. Eng. in Food Engineering, Shanghai Ocean University, China

Careers

May 2009–Present: Senior Research Officer (Permanent), Department of Food Chemistry and Technology, Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork, Ireland.

Dec 2014–Present: Adjunct Professor, College of Food Science, Fujian Agriculture and Forestry University, China

Feb 2006–May 2009: Research Manager/Drying Granulation Scientist, Foods Structural Design, Unilever Food and Health Research Institute, Unilever R&D Vlaardingen, the Netherlands.

Jan 2005–Feb, 2006: Postdoctoral Research Officer, Biotechnology Centre, Moorepark, Teagasc, Fermoy, Co. Cork. Ireland

Oct 2001–Dec 2004: Research Scientist/Ph.D. Candidate, Department of Food and Nutritional Sciences, University College Cork, Ireland.

Jan 1995–Sep 2001: Senior Lecturer, Faculty of Food Science and Technology, Shanghai Fisheries University.

Jan 1996–Sep 2001: Senior Research Fellow, Faculty of Food Science and Technology, Shanghai Fisheries University.

Expertise

- Physico-chemical properties of biomaterials.
- Dehydration and granulation.
- Novel foods structural and textural designs.
- Stickiness and flowability of powders.
- State transition and phase transition in foods.
- Encapsulation and functional food ingredients.
- Structured emulsions for functional delivery.
- Stabilization of probiotics.
- Dairy ingredients.

Selected Publications

1. Like Mao, Yrjö H. Roos, Costas G. Biliaderis and Song Miao*. 2015. Food Emulsions as Delivery Systems for Flavor Compounds – A Review, *Critical Reviews in Food Science and Nutrition*, in Press. DOI: 10.1080/10408398.2015.1098586
2. Mao, L.; Roos, Y.H.; Miao, S.*, 2015, Effect of maltodextrins on the stability and volatile release behavior of oil-in-water emulsions subjected to freeze-thaw treatment, *Food Hydrocolloids*, 50: 219–227.
3. Lu, W., Kelly, A.L., Miao, S.*, 2016, Emulsion-based encapsulation and delivery systems for polyphenols, *Trends in Food Science and Technology*, 47:1–9
4. Li, R., Roos, Y. H., Miao, S.* 2016.Flavor release from spray-dried amorphous matrix: effect of lactose content and water plasticization. *Food Research International*, 86, 147–155.
5. Ji, J., Fitzpatrick, J., Cronin, K., Maguire, P., Zhang, H., Miao, S.*, 2016. Rehydration behaviours of high protein dairy powders: The influence of agglomeration on wettability, dispersibility and solubility. *Food hydrocolloids* 58, 194–203.
6. Ji, J., Cronin, K., Fitzpatrick, J., Maguire, P., Zhang, H., Miao, S.*, 2016. The structural modification and rehydration behaviours of milk protein isolate powders: The effect of granule growth in the high shear granulation process. *Journal of Food Engineering* 189, 1–8.
7. Fitzpatrick, J.J., van Lauwe, A., Coursol, M., O'Brien, A., Fitzpatrick, K.L., Ji, J., Miao, S.*, 2016. Investigation of the rehydration behaviour of food powders by comparing the behaviour of twelve powders with different properties. *Powder Technology* 297, 340–348.

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PROFILE

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Education

Ph.D. Microbiology (1995–1999), University College Cork.

B.Sc. Microbiology (1991–1995), University College Cork.

Career

2009–Present: Senior Research Officer, Teagasc Food Research Centre, Moorepark.

2003–2009: Research Officer, Teagasc Food Research Centre, Moorepark.

2000–2002: Post-Doctoral Research Fellow, Dept. of Food Science, North Carolina State University, Raleigh, USA.

1999–2000: Post-Doctoral Research Fellow, National Food Biotechnology Centre, University College Cork.

Research Activities/interests

- Genetics and genomics of food cultures, including probiotics and fermentation starter cultures.
- Genomic analysis and characterisation of bacteriophage infecting food cultures and food pathogens.
- Evaluation of novel LAB for flavour diversification in dairy products.
- Genomic analysis and the study of persistence in *Listeria monocyotgenes.*
- Development of therapeutic uses for bacteriophage against multi-drug resistant pathogens including MRSA, *E. coli* O157:H7, *Clostridium difficile* and *Pseudomonas aeruginosa.*
- Development of detection systems for foodborne pathogens based on phage-host interactions.

Selected Publications

1. Cavanagh, D., G. F. Fitzgerald, O. McAuliffe. 2014. From field to fermentation: the origins of *Lactococcus lactis* and its domestication to the dairy environment. Food Microbiol. In press.
2. Cavanagh, D., K. Kilcawley, M. O'Sullivan, G. F. Fitzgerald, O. McAuliffe. 2014. Assessment of wild non-dairy lactococcal strains for flavour diversification in a mini Gouda type cheese model. Food Res. Int. 62: 432–440.
3. Cavanagh, D., C. M. Guinane, H. Neve, A. Coffey, R. P. Ross, G. F. Fitzgerald, O. McAuliffe. 2014. Phages of non-dairy lactococci: isolation and characterisation of ϕL47, a phage infecting the grass isolate *Lactococcus lactis* ssp. *lactis* DPC6860. Front. Microbiol. 4: 417.
4. Casey, A., E. M. Fox, S. Schmitz-Esser, A. Coffey, O. McAuliffe, K. Jordan. 2014. Transcriptome analysis of *Listeria monocytogenes* exposed to biocide stress reveals a multi-system response involving cell wall synthesis, sugar uptake and motility. Front. Microbiol. 5: 68.
5. Elbreki, M., R. P. Ross, C. Hill, J. O'Mahony, O. McAuliffe, A. Coffey. 2014. Bacteriophages and their derivatives as biotherapeutic agents indisease prevention and treatment. J. Viruses. Article ID 382539.

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PROFILE

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Education

Ph.D. Food Science and Technology – 2013, University College Cork. (Title: The impact of protein profile on the physical stability of infant formulae)

B.Sc. Food Science and Technology (2008), University College Cork.

Career

2014–Present: Research Officer (Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork)

2013–2014: Food Technologist – Abbott Nutrition (Cootehill, Co. Cavan)

2012–2013: Post-Doctoral Researcher (Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork)

Expertise

- Emulsification and rheological properties of dairy systems.
- Separation and purification of milk protein fractions by membrane filtration.
- Factors affecting powder characteristics and functionality during spray drying.
- Protein powder solubility and dispersion mechanisms.

Selected Publications

1. McCarthy, N. A., Kelly, A. L., O'Mahony, J. A., Hickey, D. K., Chaurin, V., & Fenelon, M. A. (2012). Effect of protein content on emulsion stability of a model infant formula. *International Dairy Journal, 25*, 80–86.
2. McCarthy, N.A., Kelly, A.L., O'Mahony, J.A., Fenelon, M.A., (2013). The physical characteristics and emulsification properties of partially dephosphorylated bovine β-casein. *Food Chemistry, 138,* 1304–1311.
3. McCarthy, N. A., Kelly, A. L., O'Mahony, J. A., & Fenelon, M. A. (2014). Sensitivity of emulsions stabilised by bovine β-casein and lactoferrin to heat and CaCl2. *Food Hydrocolloids, 35*(0), 420–428.
4. McCarthy, N.A., Kelly, A.L., O'Mahony, J.A., Fenelon, M.A., (2013). The physical characteristics and emulsification properties of partially dephosphorylated bovine β-casein. *Food Chemistry, 138,* 1304–1311.
5. McCarthy, N. A., Kelly, P. M., Maher, P. G., & Fenelon, M. A. (2014). Dissolution of milk protein concentrate (MPC) powders by ultrasonication. *Journal of Food Engineering, 126*(0), 142–148.

Technology

PROFILE

Dr. Sinéad McCarthy

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Education

Dr. Sinéad McCarthy graduated with a B.Sc from UCC in 1993. She also completed an M.Sc in UCC in 1996, where she studied dietary vitamin E and lipid stability in turkey tissues. In 2003, she graduated from UCC with a Ph.D., in the area of public health nutrition which examined the predictors and prevalence of obesity in Irish adults.

Career

For nearly two decades, Sinéad has been involved in many areas of nutrition research, with a focus on food and health and has published extensively.

Sinéad's first research post in UCC was the area of human nutritional physiology, examining the anti – oxidative effects of carotenoid and fish oil consumption, as a part of two multi centred EU projects. In 1997, Sinéad moved to TCD as a research officer on the Irish National Food Consumption programmes, from which she was awarded her Ph.D. and attained funding to conduct additional food consumption surveys. She was the Scientific Officer on the Framework 6 Lipgene project and was actively involved in the human nutrition dietary intervention work-package of Lipgene. In 2007, Sinéad joined Teagasc at Ashtown Food Research Centre, where she is responsible for leading Teagasc's consumer behaviour research programme in relation to food and health. She is actively involved in the area of consumer food choice determinants and its potential impact on health. Sinéad is a member of the Food Safety Authority of Ireland Public Health Nutrition sub-committee and the Nutrition and Health Foundation Scientific committee. She is also an active member of the Nutrition Society.

Expertise

Sinéad has significant expertise in the areas of consumer behaviour in relation to nutrition, food and health. She has extensive experience in designing national food consumption surveys in addition to designing and validating consumer behaviour questionnaires. She is experienced in qualitative research techniques such as focus groups and in-depth interviews and has extensive analytical skills using large consumer databases and biostatistics. She has developed a reputation in this area both nationally and internationally and this has been demonstrated in her success in securing external funding. She is involved in many on-going projects covering sensory science, consumer food and health behaviour, food expenditure patterns, consumer acceptance of novel food technologies, consumer acceptance of marine derived functional foods and drivers of cheese consumption. Sinead is also one of the co-ordinators of the newly formed Sensory Food Network Ireland.

Selected Publications

1. McCarthy SN. Weekly patterns, diet quality and energy balance Physiology & Behaviour 2014:555–59.
2. Greehy, G.M.; McCarthy, M.B.; Henchion, M.M.; Dillon, E.J.; McCarthy, S.N. Complexity and conundrums. Citizens' evaluations of potentially contentious novel food technologies using a deliberative discourse approach Appetite, 2013:37–46.
3. Newcombe M, McCarthy M, Cronin JM, McCarthy SN, "Eat like a man": A Social Constructionist Analysis of the Role of Food in Men's Lives. Appetite, 2012:391–8.
4. Shaw D, Tierney A, McCarthy S, Upritchard J, Vermunt S, Gulseth H, Drevon CA, Blaak E, Saris WHM, Karlstrom B, Helal O, Defoort C, Gallego R, Lopez – Miranda J, Siedlecka D, Malczewska-Malec M, Roche HM and Lovegrove JA. LIPGENE food-exchange model for alteration of dietary fat quantity and quality in free-living participants from eight European countries. British J Nutr (2009), 101, 750–759.
5. Joyce T, McCarthy SN, Gibney MJ. Relationship between energy from added sugars and frequency of added sugars intake in Irish children, teenagers and adults. Br J Nutr. 2008 May;99(5):1117–26.

Technology

PROFILE

Ciara McDonagh

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Education

M.Sc. (Agricultural Science) 1998–2000
National University College Dublin (UCD).

B.Sc. (Applied Sciences – Food Science and Technology) 1993–1997. Dublin Institute of Technology, Kevin St. – awarded by Trinity College Dublin.

Career

2010–Present: Food Industry Development, Teagasc Food Research Centre, Ashtown.

2005–2010: Innovation Unit Manager, Teagasc Food Research Centre, Ashtown.

2001–2004: Research Officer, Meat Technology Department, Teagasc.

2000–2001: Research Assistant, National Food Biotechnology Centre, NUI, Cork.

Expertise

Ciara plays an integral role in the food industry development programme, providing direct technology development support to the food processing industry through product development, contract research, training, consultancy and information services. Working with the Technology Transfer Office, Ciara has developed the Teagasc Portfolio of Technologies to ensure the early transfer to industry of knowledge generated from the Teagasc food research programme. She is also responsible for the delivery of the Food Innovation Gateways Events, showcasing these technologies to industry. In addition, she manages the Teagasc Customer Relationship Management System, which has been developed to support interactions with industry, streamline information exchange and ensure innovation needs are being met.

Selected Publications

1. McDonagh, C. (2009). Technology Transfer Guides for the Meat Sector
2. McDonagh, C., Sommerfield, A., O'Neill, E., and McCarthy, P. (2006). From Concept to Completion – A Roadmap for Entrepreneurs.
3. Mc Donagh, C., Mullen, A.M, Kerry J.P. & Troy, D.J. (2006). Evaluation of inherent variation in porcine M. *thoracis* et *lumborum* and M. *semimembranosus*. *Journal of the Science of Food and Agriculture*. 86(2), 292–298.
4. Mc Donagh, C., Kerry J.P., Troy, D.J. & Mullen, A.M. (2005). Relationship between the subjective and objective assessment of pork M. *semimembrosus* and prediction of further processed pork quality. Food Science and Technology International. 11(2), 149–154
5. 2005–2012: Confidential Research Reports for client companies.

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Agriculture and Food Development Authority

Technology

PROFILE

Dr. Aidan Moloney

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Education

B.Sc. University College, Galway, Ireland. 1979

Ph.D. University College, Galway, Ireland. 1984

Diploma in Statistics, University of Dublin, 1997

Career

1984–1989: Research Officer, Grange Research Centre

1984–1985: Visiting Scientist, Grassland Research Institute, UK

1989–1998 :Senior Research Officer, Grange

1993–1994: Fulbright Scholar, Cornell University, USA

1998–2001: Senior Research Officer, Food Research Centre, Ashtown

2001–2010: Principal Research Officer, Food Research Centre, Ashtown

2010–Present: Principal Research Officer, Animal and Biosciences Department, Grange

Expertise

My primary research interests relate to relationships between production factors, in particular nutrition, and the appearance, composition and sensory quality of beef and the development of procedures to authenticate the dietary history and geographical origin of beef. A recent focus was on increasing the concentrations of omega-3 polyunsaturated fatty acids and conjugated linoleic acid (CLA) in beef with a particular interest in strategic supplementation of grazing cattle to achieve this goal. Recent work includes an examination of potential sources of variation in the CLA concentration in muscle with a focus on rumen digestion of dietary fatty acids and expression of selected genes involved in tissue lipid metabolism. Current projects focus on the relationship between bull beef production systems and the colour and sensory quality of meat and the quality of beef from cattle consuming only grass and grass-based products throughout their life.

Selected Publications

1. Moloney, A.P. and Drennan, M.J. (2013). Characteristics of fat and muscle from beef heifers offered a grass silage or concentrate-based finishing ration. *Livestock Science* 152,147–153.
2. Dunne, P., Monahan, F.J. and Moloney, A.P. (2011). Current perspectives on the darker beef often reported from extensively-managed cattle: Does physical activity play a significant role? *Livestock Science* 142, 1–22.
3. Moloney, A.P., Mooney, M.T., Kerry, J.P., Stanton, C. and O'Kiely, P. (2013). Colour of fat, and colour, fatty acid composition and sensory characteristics of muscle from heifers offered alternative forages to grass silage in a finishing ration. *Meat Science* 95, 608–615.
4. Osorio, M.T., Downey, G., Moloney, A.P., Rohrle, F.T., Luciano, G., Schmidt, O. and Monahan, F.J. (2013). Beef authentication using dietary markers: Chemometric selection and modelling of significant beef biomarkers using concatenated data from multiple analytical methods. *Food Chemistry* 141, 2795–2801.
5. Moloney, A.P., Kennedy, C., Noci, F., Monahan, F.J. and Kerry, J.P. (2012). Lipid and colour stability of M. longissimus muscle from lambs fed camelina or linseed as oil or seeds. *Meat Science* 92,,1–7.
6. Osorio, T.M., Moloney, A.P., Brennan, L. and Monahan, F.J. (2012). Authentication of beef production systems using a metabolomic-based approach. *Animal* 6, 167–172.

Technology

PROFILE

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Education

B.Sc. University of Limerick, Ireland. 2000

Ph.D. University of Limerick, Ireland. 2004

Career

2002: R&D Analyst, Clonmel Healthcare

2004: Research Assistant, Universtiy of Limerick

2004–2005: Quality Analyst, Medtronic Vascular, Galway

2005–2006: Research Officer, Residue Laboratories, Teagasc Food Research Centre, Ashtown

2006–Present: Laboratory Technologist, Residue Laboratories, Teagasc Food Research Centre, Ashtown

Expertise

I assist in the management of the Residues laboratories as Deputy Head of Laboratory and Deputy Quality Manager. The Residue laboratories are accredited to ISO 17025 and function as a national reference laboratory.

My expertise is primarily in the area of contaminant analysis, focussing on foods of animal origin. I have worked extensively in the area of coccidiostat feed additives and veterinary drugs developing and validating multi-residue methods for the determination of coccidiostats in target and non-target tissues. Other areas of interest include nitrofurans, nitroimadazoles, carbmates and anthelmintics. I am currently working on multi-residue methods for antibiotics in aquaculture and pesticides in animal fat in particular the pyrethroid pesticides. I work primarily with UHPLC coupled to tandem mass spectrometry but also have some experience screening technologies.

Selected Publications

1. Moloney, M., Clarke, L., O'Mahoney, J., Gadaj, A., O'Kennedy, R., Danaher, M. (2012) Determination of 20 coccdiostats in egg and avian muscle tissue using ultra high performance liquid chromatography coupled to tandem mass spectrometry. *Journal of Chromatography A,* 1253, 94–104.
2. Clarke, L., P., Moloney, M., O'Mahoney, J., O'Kennedy, R., Danaher, M. (2013) Determination of 20 coccdiostats in milk, duck muscle and non-avin muscle using UHPLC-MS/MS. *Food Addtives and Contaminants,* Part A, 30, 6, 958–969.
3. Whelan, M., Kinsella, B., Furey, A., Moloney, M., Cantwell, H., Lehotay, S.J., Danaher, M (2010) Determination of anthelmintic drug residues in milk using ultra high performance liquid chromatography-tandem mass spectrometry with rapid polarity switching. *Journal of Chromatography A*, 1217, 27, 4612–4622.
4. Radovnikovic, A., Moloney, M., Byrne, P., Danaher, M. (2011) Detection of banned nitrofuran metabolites in animal plasma samples using UHPLC-MS/MS. *Journal of Chromatography B*, 879, 2, 159–166.
5. Vinogradova, T., Danaher, M., Baxter, A., Moloney, M., Victory, D., Haughey, S.A. (2011). Rapid surface plasmon resonance immunobiosensor assay for microcystin toxins in blue green algae food supplements. *Talanta, 84*, 3, 638–643.

Technology

PROFILE

Dr. Sheila Morgan

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Education

B.Sc., NUI Maynooth.

Ph.D., University College Cork.

Career

1997–Present: Teagasc, Food Research Centre, Moorepark.

1995–1997: Microbiology Department, University College Cork.

Expertise

- Antimicrobial research (food and biomedical).
- Antimicrobial powder development.
- Gut microbiology and the effect of antimicrobials on gut populations.
- Scientific administration and project management.

Sheila currently works as a project manager for a number of large funded projects including the APC Microbiome Institute (www.apc.ucc.ie), Food for Health Ireland (www.fhi.ie) and the Dairy Processing Technology Centre (www.dptc.ie).

Selected Publications

1. Fate of the two-component lantibiotic lacticin 3147 in the gastrointestinal tract. Gardiner GE, Rea MC, O'Riordan B, O'Connor P, Morgan SM, Lawlor PG, Lynch PB, Cronin M, Ross RP, Hill C. Appl Environ Microbiol. 2007 73: 7103–9.
2. A lacticin 3147 enriched food ingredient reduces Streptococcus mutans isolated from the human oral cavity in saliva. O'Connor EB, O'Riordan B, Morgan SM, Whelton H, O'Mullane DM, Ross RP, Hill C. J Appl Microbiol. 2006 100:1251–60
3. Sequential actions of the two component peptides of the lantibiotic lacticin 3147 explain its antimicrobial activity at nanomolar concentrations. Morgan SM, O'Connor PM, Cotter PD, Ross RP, Hill C. Antimicrob Agents Chemother. 2005 49: 2606–11.
4. Evaluation of a spray-dried lacticin 3147 powder for the control of Listeria monocytogenes and Bacillus cereus in a range of food systems. Morgan SM, Galvin M, Ross RP, Hill C. Lett Appl Microbiol. 2001 33: 387–91.
5. Efficient method for the detection of microbially-produced antibacterial substances from food systems. Morgan SM, Hickey R, Ross RP, Hill C. J Appl Microbiol. 2000 89: 56–62.

Technology

PROFILE

Dr. Anne Maria Mullen

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Education

B.Sc. Biochemistry (1991), University College Galway
Ph.D. (1995) Pharmacology, University College Galway

Career

Current: Principal Research Officer, Teagasc Food Research Centre, Ashtown

1996–1998: Contract Research Officer, Teagasc Food Research Centre, Ashtown

Expertise

Dr. Mullen is currently overseeing the research programme for recovery of value from meat by-product and waste streams. Her research interests also address issues relating to various aspects of meat processing (post slaughter interventions) and meat quality (technological, eating etc.). In particular she has focused on biochemical and molecular factors underpinning variability in meat quality and the impact of post-mortem process interventions on product quality. Dr. Mullen was responsible for expanding the meat research programme to incorporate the application of relevant genome and proteome platforms in addressing issues of importance in meat quality. She has co-ordinated and collaborated on projects funded through EU Framework, FIRM (Irish) and Enterprise Ireland. In addition, Dr. Mullen served as Head of Department leading a staff of up to 20 comprising permanent and contract researchers, technical personnel and students. Publications relate to molecular basis of meat quality, recovery of value from meat processing streams, and general meat quality. She has presented her research on many occasions at international and national conferences; she is a member of the Enterprise Ireland – Global Skills Team (Pet Food). She regularly contributes to proposal and Ph.D. evaluations at national and international levels and is also involved with training and information programmes in meat technology for the Irish meat industry and relevant agencies.

Selected Publications

1. Mullen, A.M. and Álvarez C. (2016) Offal: Types and Composition, In Encyclopedia of Food and Health, Academic Press, Oxford, Pages 152–157, ISBN 9780123849533.
2. Lomas, A.J., Ryan, C.N.M., Sorushanova, A., Shologu, N., Sideri, A.I., Tsioli, V., Fthenakis, G., Tzora, A., Skoufos, G., Quinlan, L., O'Laighin, G., Mullen, A.M., Kelly, J.L., Kearns, S., Biggs, M., Pandit, A., Zeugolis, D.I. (2015) 'The Past, Present and Future in Scaffold-based Tendon Treatments.' Advanced Drug Delivery Reviews. 84, 257–277.
3. Anne Maria Mullen, Carlos Álvarez, Milica Pojić, Tamara Dapčević Hadnadev and Maria Papageorgiou (2015) Chapter 2 – Classification and target compounds, In Food Waste Recovery, edited by Charis M. Galanakis,, Academic Press, San Diego, Pages 25–57, ISBN 9780128003510.
4. Marcos, B. and Mullen, A.M. (2014) High pressure induced changes in beef muscle proteome: Correlation with quality parameters, Meat Science, Volume 97, Issue 1, May 2014, Pages 11–20.
5. Claire C. O'Flynn, Malco C. Cruz-Romero, Declan Troy, Anne M. Mullen, Joe P. Kerry (2014), The application of high-pressure treatment in the reduction of salt levels in reduced-phosphate breakfast sausages, Meat Science, Volume 96, Issue 3, Pages 1266–1274.
6. Di Luca, A, Elia, G.,, Hamill, R. and Mullen, A.M. (2013). 2-D DIGE proteomic analysis of early post mortem muscle exudate highlights the importance of the stress response for improved water-holding capacity of fresh pork meat. Proteomics 13, 9, 1528–1544.
7. Hamill, R., Ozlem Aslan, Mullen, A.M., O'Doherty, JV, McBryan, J, Morris, D.G. and Torres Sweeney (2013). Transcriptome analysis of porcine M. semimembranosus divergent in intramuscular fat as a consequence of dietary protein restriction. BMC Genomics 14:453–467.

Technology

PROFILE

Dr. Kanishka N. Nilaweera

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Education

Ph.D. Neuroscience, University of Aberdeen, UK. (2002).

B.Sc., University of Aberdeen, UK. (1998).

Careers

2009–Present: Senior Research Officer, Teagasc, Moorepark Food Research Centre, Fermoy, County Cork, Ireland.

2007–2009: Post-doctoral Research Associate, School of Biomedical Sciences, University of Nottingham, UK.

2005–2007: Post-doctoral Research Associate, Rowett Research Institute, Aberdeen, UK.

2002–2005: Post-doctoral Research Assistant, Rowett Services Ltd, Aberdeen UK.

1996–1997: Industrial Student Placement, Molecular and Cell Biology Department, Zeneca Pharmaceuticals, UK.

Expertise

My research aims to identify nutrients that reduce weight gain, so that these could be commercialised as Functional Food ingredients to tackle the obesity problem. This work involves animal feeding trials. Utilising this approach, we have shown that whey protein isolate (a by-product of cheese manufacture) reduces weight gain by decreasing the size of the gut. Moreover, bovine serum albumin, a constituent protein within the isolate, has a greater suppressive effect on weight gain.

Selected Publications

1. McAllan, L, Speakman, J.R., Cryan, J.F. and Nilaweera, KN. Whey protein isolate decreases murine stomach weight and intestinal length and alters the expression of Wnt signalling associated genes. *British Journal of Nutrition* 2015,113; 372–379.
2. McManus BL, Korpela R, Speakman JR, Cryan JF, Cotter PD, Nilaweera KN. Bovine serum albumin as the dominant form of dietary protein reduces subcutaneous fat mass, plasma leptin and plasma corticosterone in high fat-fed C57/BL6J mice. *British Journal of Nutrition* 2015;114; 654–662.
3. McManus BL, Korpela R, O'Connor P, Schellekens H, Cryan JF, Cotter PD, Nilaweera KN. Compared to casein, bovine lactoferrin reduces plasma leptin and corticosterone and affects hypothalamic gene expression without altering weight gain or fat mass in high fat diet fed C57/BL6J mice. *Nutrition & Metabolism* 2015, 12;53.
4. Finucane OM, Lyons CL, Murphy AM, Reynolds CM, Klinger R, Healy NP, Cooke A, Coll R, McAllan L, Nilaweera KN, O'Reilly M, Tierney AC, Morine MJ, Alcala-Diaz JF, Lopez-Miranda J, O'Connor DP, O' Neill L, McGillicuddy FC, and Roche HM. Monounsaturated fatty acid enriched high fat-diets impede adipose NLRP3 inflammasome mediated IL-1β secretion and insulin resistance despite obesity. *Diabetes* 2015;64:2116–28.
5. McAllan L, Skuse P, Cotter PD, O'Connor P, Cryan JF, Ross RP, Fitzgerald G, Roche HM, Nilaweera KN. Protein quality and the protein to carbohydrate ratio within a high fat diet influences energy balance and the gut microbiota in C57BL/6J mice. *PLoS One* 2014; 10;9(2):e88904.

Technology

PROFILE

Dr. Orla O'Sullivan

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Education

B.Sc. University College, Cork, Ireland. 2000

Ph.D. University College, Cork, Ireland. 2001

Career

2004: Post-Doctoral Research Scientist, Conway Institute, University College Dublin

2005: Senior Demonstrator/Lecturer, Department of Biochemistry, University College Cork

2006–2007: Research Officer, Teagasc Food Research Centre, Moorepark

2008–2013: Researcher, ELDERMET, University College Cork and Teagasc Food Research Centre, Moorepark

2014: Research Fellow, Alimentary Pharmabiotic Centre and Teagasc Food Research Centre, Moorepark

2014–Present: SIRG Research Fellow, Teagasc Food Research Centre, Moorepark

Expertise

Orla is a bioinformatician working on the food programme in Teagasc. Her primary research focus is on the genomics of single bacteria and phage and metagenomics of various environments including human gut and lung, rumen and food. Understanding the genomes of bacteria and phage can aid in the identification of genes responsible for certain traits including flavour and textures in food and probiotics and antibiotic resistance in health. Metagenomic analysis allows both the community profiling and functional analysis of the microbiota of an environment and lends itself to identifying fluxes in bacterial populations in health versus disease, at stage of life (e.g. infant versus elderly) and causative factors in food spoilage. Of particular interest to her is the role of exercise and diet, particularly whey protein, on the human gut microbiome in elite athletes, and in healthy and diseased cohorts.

Selected Publications

1. Claesson, M. J., Jeffery, I. B., Conde, S., Power, S. E., O'Connor, E. M., Cusack, S., Harris, H. M., Coakley M., Lakshminarayanan, B., O'sullivan, O., Fitzgerald, G. F., Deane, J., O'Connor, M., Harnedy, N., O'Connor, K., O'Mahony, D., Van Sinderen, D., Wallace, M., Brennan, L., Stanton, C., Marchesi, J. R., Fitzgerald, A. P., Shanahan, F., Hill, C., Ross, R. P. & O'Toole, P. W. (2012) Gut Microbiota composition correlates with diet and health in the elderly. *Nature,* 488**,** 178–84.
2. Clarke, S. F., Murphy, E. F., O'Sullivan, O., Lucey, A. J., Humphreys, M., Hogan, A., Hayes, P., O'Reilly, M., Jeffery, I. B., Wood-Martin, R., Kerins, D. M., Quigley, E., Ross, R. P., O'Toole, P. W., Molloy, M. G., Falvey, E., Shanahan, F. & Cotter, P. D. (2014) Exercise and associated dietary extremes impact on gut microbial diversity. *Gut,* 63**,** 1913–20.
3. O'Sullivan, O., Rea, M. C., Shanahan, F., O'Toole, P. W., Stanton, C., Ross, R. P. & Hill, C. (2012) Clostridium difficile carriage in elderly subjects and associated changes in the intestinal microbiota. *J Clin Microbiol,* 50**,** 867–75.
4. Lavelle, A., Lennon, G., O'Sullivan, O., Docherty, N., Balfe, A., Maguire, A., Mulcahy, H. E., Doherty, G., O'Donoghue, D., Hyland, J., Ross, R. P., Coffey, J. C., Sheahan, K., Cotter, P. D., Shanahan, F., Winter, D. C. & O'Connell, P. R. (2015) spatial variation of the colonic microbiota in patients with ulcerative colitis and control volunteers. *Gut*.
5. O'Sullivan, O., Cronin, O., Clarke, S. F., Murphy, E. F., Molloy, M. G., Shanahan, F. & Cotter, P. D. (2015) Exercise and the Microbiota. *Gut Microbes,* 6**,** 131–6.

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Technology

PROFILE

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Education

Ph.D.: Karolinska Institute, Stockholm, Sweden. 2003.

B.Sc.: Trinity College Dublin, Ireland, 1998.

Diploma: DIT Kevin Street, Dublin, Ireland, 1998.

Career

2009–Present: Senior Research Officer, Teagasc Food Research Centre, Ashtown, Dublin 15.

2013–Present: Adjunct Lecturer, School of Chemistry and Chemical Biology, University College Dublin.

2014–Present: Scientific Committee Member of the EU COST Action FA1403: Plant Bioactives inter-Individual Variation.

2003–2008: Post-Doctoral Research Scientist, Centre for Synthesis and Chemical Biology, University College Dublin.

Expertise

Dr. Rai leads a research team in the field of nutraceuticals in recovering and characterising food molecules that possess health-promoting effects. He has published numerous research articles in assessing the effect of various food-processing (domestic, industrial and novel physical) technologies on the levels of health-benefiting plant – molecules with emphasis on Irish grown plant foods such as barley, carrots, broccoli, mushrooms and onions. He currently leads research projects focusing on valorisation of food-processing by-products to generate sustainable sources of functional food ingredients (molecules) and bio-fuels.

Selected Publications

1. Hossain, M.B., Brunton, N.P., and Rai, D.K. (2016). Effect of drying methods on the steroidal alkaloid content of potato peels, shoots and berries. Molecules, 21(4): 403–413.
2. Gangopadhyay, N., Rai, D.K., Brunton, N.P., Gallagher, E., and Hossain, M.B.(2016). Antioxidant-guided isolation and mass spectrometric identification of the major polyphenols in barley (Hordeum vulgare) grain. Food Chemistry, 210, 212–220.
3. Lafarga, T., Rai, D.K., O'Connor, P., and Hayes, M. (2016). Generation of bioactive hydrolysates and peptides from bovine hemoglobin with in vitro renin, angiotensin-I-converting enzyme and dipeptidyl peptidase-IV inhibitory activities. Journal of Food Biochemistry, DOI: 10.1111/jfbc.12259.
4. Gangopadhyay, N., Wynne, K., O'Connor, P., Gallagher, E.,., Brunton, N.P., Rai, D.K., and Hayes, M. (2016). In silico and in vitro analyses of the angiotensin-I converting enzyme inhibitory activity of hydrolysates generated from crude barley (Hordeum vulgare) protein concentrates. Food Chemistry, 203, 367–374.
5. Aguiló-Aguayo, I., Suarez, M., Plaza, L., Hossain, M. B.; Brunton, N.; Lyng, J.G.; and Rai, D.K. (2015). Optimization of pulsed electric field pre-treatments to enhance health-promoting glucosinolates in broccoli flowers and stalk. *Journal of the Science of Food and Agriculture*, 95 (9): 1868–1875.

Technology

PROFILE

Dr. Mary C. Rea

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Education

B.Sc., M.Sc. and Ph.D. in Microbiology from University College Cork.

Career

1976–1977: Research Assistant Clinical Biochemistry Department, St Finbarr's Hospital Cork.

1977–1981: Contract Research Officer, An Foras Taluntais, Moorepark.

1989–2008: Contract Research Officer, Cheese Microbiology and Biotechnology Departments and member of the SFI funded Alimentary Pharmabiotic Centre.

2008–Present: Senior Research Officer in the Biosciences Department, Teagasc Food Research Centre, Moorepark.

Expertise

- Food preservation and biomedical applications of bacteriocins.
- Mining the GIT for antimicrobial producing bacteria targeting gut pathogens including *Clostridium difficile*, *Salmonella* sp, *Listeria monocytogenes* and *Cronobacter sakazakii*.
- Cheese microbiology including the microflora of smear ripened cheese.
- *Mycobacterium avium paratuberculosis*: survival in dairy foods.

Selected Publications

1. M.C. Rea, O. O'Sullivan, F. Shanahan, P.W. O'Toole, C. Stanton, R.P. Ross and C. Hill. (2012). *Clostridium difficile* carriage in elderly subjects and associated changes in the intestinal microbiota J. Clin. Microbiol., 50:867–875.
2. M.C. Rea, A. Dobson, O.O'Sullivan, F. Crispie, F. Fouhy, PC. Cotter, F. Shanahan, B. Kiely, C. Hill and RP. Ross (2011). Effect of broad – and narrow – spectrum antimicrobials on *Clostridium difficile* and microbial diversity in a model of the distal colon. Sackler Symposium Microbes and Health Proc. Natl. Acad. Sci. USA, 108 Suppl 1: 4639–4644.
3. K. Murphy, O'Sullivan O, Rea MC, Cotter PD, Ross RP, Hill C. (2011). Genome mining for radical SAM protein determinants reveals multiple sactibiotic-like gene clusters. PLoS One 6:e20852. Epub 2011 Jul 8.
4. Dobson A, Crispie F, Rea MC, O'Sullivan O, Casey PG, Lawlor PG, Cotter PD, Ross P, Gardiner GE, Hill C (2011) Fate and efficacy of lacticin 3147-producing Lactococcus lactis in the mammalian gastrointestinal tract.FEMS Microbiol Ecol.76:602–14.
5. Field, D., Quigley, L., O'Connor, P., M.C. Rea, Daly, K., Cotter, P., Hill, C. and Ross, R.P. (2010). Studies with Bioengineered Nisin peptides highlight the broad-spectrum potency of Nisin V. Microbial Biotechnology 3: 4, 473–486.
6. M.C. Rea, CS. Sit, E. Clayton, PM. O'Connor, RM. Whittal, J. Zheng, JC. Vederas, R P. Ross and C Hill (2010). Thuricin CD, a novel post-translationally modified bacteriocin with a narrow spectrum of activity against *Clostridium difficile*. Proc. Natl. Acad. Sci. USA, 107: 9352–9357.

Technology

PROFILE

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Education

Ph.D. Food Science and Technology (Food Chemistry).
M.Sc. Food Science and Technology (Food Technology).
B.Sc. Food Science and Technology.

Career

2011–Present: Programme Manager – Cheese, Dairy Innovation Centre.

2001–Present: Research Officer, Teagasc. 1995–2001: Cheese Technologist, M.T.L. /Teagasc.

Expertise

Diarmuid's research programme is focused on technological and biochemical aspects of cheese manufacture and ripening key to enabling diversification of a predominantly Cheddar based Irish cheese industry. His research is also focused on investigation of factors influencing cheese quality and consistency. In particular, his research seeks to determine the influence of varying cheese manufacture parameters on localised variability in curd microstructure, compositional profile, physico-chemical parameters and on bacterial profiles and metabolic activity. This serves to underpin development of (i) novel hybrid cheeses, combining characteristics of diverse cheese types but capable of manufacture on Cheddar-type process plants and (ii) diverse continental cheese types for manufacture on plants with brine salting facilities. In addition his programme focuses on determining the influence of underlying biochemical and microbial factors on specific quality issues (e.g. pink defect, eye quality and split defects) of continental – type cheeses manufactured from a seasonal Irish milk supply.

Selected Publications

1. Hickey, C. D., Auty, M.A.E., Wilkinson, M.G., and Sheehan, J.J. (2015). The influence of cheese manufacture parameters on cheese microstructure, microbial activity and their interactions during ripening: A Review. *Trends in Food Science and Technology (In press).*
2. El-Bakry M, and Sheehan, J.J. (2014). Analysing Cheese Microstructure: A Review of Recent Developments, *Journal of Food Engineering*, *125,* 84–96.
3. Sheehan, J.J. (2013). Milk quality and cheese diversification. *Irish Journal of Agricultural and Food Research, 52,* 243–253.
4. O'Sullivan, D., Giblin, L., McSweeney, P.L.H., Sheehan, J.J., and Cotter, P. D. (2013). Nucleic acid-based approaches to investigate microbial-related cheese quality defect, *Frontiers in Microbiology*, http://www.frontiersin.org/Journal/Abstract.aspx?s=441&name=food_microbiology&ART_DOI=10.3389/fmicb.2013.00001.
5. Daly, D.F.M., McSweeney, P.L.H. and Sheehan, J.J. (2010). Split defect and secondary fermentation in Swiss-type cheeses – a review. *Dairy Science and Technology*, 90, 3–26.

Technology

PROFILE

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Education

Hull University 1983–1986, B.Sc. (Hons) Biology, Second Class, Division One.

University College Cork, 1986–1988, M.Sc. Biotechnology.

Antibiotic inhibition of fungal pathogens by root colonizing fluorescent Pseudomonas species.

University College Cork, 2002–2005, Ph.D. Microbiology.

Pediococci and Bifidobacteria: Isolation, Genomic Characterisation and Evaluation for Probiotic Applications in Humans and Animal.

Career

1999–Present: Research Officer, Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork.

1995–1999: Higher Scientific Officer, Medical Research Council, Radiation and Genome Stability Unit, Harwell, Oxon, England.

1988–1995: Scientific Officer, Medical Research Council, Radiation and Genome Stability Unit, Harwell, Oxon, England.

Expertise

My principle areas of expertise include the isolation, characterization and fermentation of bacteria, relating to probiotic applications and functional food ingredients. Techniques encompass the use of molecular genetic methods such as Pulse-Field-gel-Electrophoresis and PCR, proteomics, specifically 2D Gels, HPLC, Gas Chromatography, Mass Spectroscopy, Spray and Freeze-drying.

Selected Publications

1. Simpson, P.J., Stanton, C., Fitzgerald, G. F., and Ross, R.P. Genomic diversity within the genus *Pediococcus* as revealed by randomly amplified polymorphic DNA PCR and pulsed-field gel electrophoresis. Appl. Environ. Microbiol., 68: 765–771, 2002.
2. Simpson, P.J., Stanton, C., Fitzgerald, G. F., and Ross, R.P. Genomic diversity and relatedness of bifidobacteria from a porcine cecum. J. Bacteriology, 185: 2571–2581, 2003.
3. Simpson, P.J., Fitzgerald, G. F., Ross, R.P., and Stanton, C. The evaluation of a mupirocin based selective medium for the enumeration of bifidobacteria from probiotic animal feed J. Microbiol. Methods, 57:9–16, 2004.
4. Simpson, P.J., Fitzgerald, G. F., Ross, R.P., and Stanton, C. *Bifidobacterium psychraerophilum* sp. nov. and *Aeriscardovia aerophila* gen. nov., sp. nov., isolated from a porcine caecum. Int. J. System. Evol. Microbiol., 54:401–406, 2004.
5. Simpson, P. J., C. Stanton, G. F. Fitzgerald, and R. P. Ross. Intrinsic tolerance of Bifidobacterium species to heat and oxygen and survival following spray drying and storage. J. Appl. Micro. 99:493–501, 2005.

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PROFILE

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Education

B.Sc (Hons, 2.1) Nutrition/Food Chemistry, (1983) University College Cork (Awarding Body: NUI).

M.Sc Nutrition (1986) University College Cork (NUI) (Awarding Body: NUI).

Ph.D Biochemistry (1988) Bournemouth University, UK (Awarding Body: Council for National Academic Awards, CNAA, UK).

D.Sc. (2008) National University of Ireland (Awarding Body: NUI).

Career

2016: Research Professor, College of Medicine and Health, University College Cork.

2012: Adjunct Professor, College of Medicine and Health, Dept. of Psychiatry, University College Cork.

2003–Present: Principal Investigator, Alimentary Microbiome Institute, (APC)

2003–Present: Principal Research Officer, Teagasc , Moorepark, Fermoy, Co. Cork

2001–2002: Senior Research Officer, Teagasc, Moorepark, Fermoy, Co. Cork

1994–2000: Research Officer, Teagasc, Moorepark, Fermoy, Co. Cork

1992–1994: Research Associate, Wake Forest Univ. Medical Center, NC, USA

1990–1992: Postdoctoral Fellow, Wake Forest University Med. Center, NC, USA

1989–1990: Senior Research Scientist, Johnson & Johnson UK, Glasgow, Scotland

Expertise

- Nutritional aspects of dairy foods, functional foods.
- Probiotic cultures: health benefits, bioactive metabolite production and host health.
- Infant gut microbiota: Influence of Dietary and Environmental Factors.
- Probiotics: technological aspects, development of functional foods.
- Bioactive lipids: Microbial production of bioactive FA, CLAs, SCFA, n-3 FA, lipids and health benefits.
- Bioactive peptides.

Selected Publications

1. Marques TM, Patterson E, Wall R, O'Sullivan O, Fitzgerald GF, Cotter PD, Dinan TG, Cryan JF, Ross RP, Stanton C. (2016). Influence of GABA and GABA-producing Lactobacillus brevis DPC 6108 on the development of diabetes in a streptozotocin rat model. Benef Microbes. Mar 25:1–12. [Epub ahead of print]
2. Ryan PM, Burdíková Z, Beresford T, Auty MA, Fitzgerald GF, Ross RP, Sheehan JJ, Stanton C. (2015). Reduced-fat Cheddar and Swiss-type cheeses harboring exopolysaccharide-producing probiotic Lactobacillus mucosae DPC 6426. J Dairy Sci. Dec;98(12):8531–44. doi: 10.3168/jds.2015–9996. Epub 2015 Sep 26.
3. Ryan PM, Ross RP, Fitzgerald GF, Caplice NM, Stanton C. (2015). Functional food addressing heart health: do we have to target the gut microbiota? Curr Opin Clin Nutr Metab Care. Nov;18(6):566–71. doi: 10.1097/MCO.0000000000000224.
4. Robertson RC, Guihéneuf F, Bahar B, Schmid M, Stengel DB, Fitzgerald GF, Ross RP, Stanton C. (2015). The Anti-Inflammatory Effect of Algae-Derived Lipid Extracts on Lipopolysaccharide (LPS)-Stimulated Human THP-1 Macrophages. Mar Drugs. Aug 20;13(8):5402–24. doi: 10.3390/md13085402
5. Marques, T. M., Wall, R., O'Sullivan, O., Fitzgerald, G. F., Shanahan, F., Quigley, E. M., Cotter, P. D., Cryan, J. F., Dinan, T. G., Ross, R. P. & Stanton, C. (2015). Dietary trans-10, cis-12-conjugated linoleic acid alters fatty acid metabolism and microbiota composition in mice. British Journal of Nutrition, 113: 728–738.

Technology

PROFILE

Dr. Brijesh Tiwari

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Education

B.Sc. Govind Ballabh Pant University of Agriculture and Technology, India. 2001

M.Sc. Central Food Technological Research Institute, India, 2003

Ph.D. University College Dublin, Ireland, 2009

Career

2013–Present: Senior Research Officer, Teagasc Food Research Centre, Dublin

2015 –Present: Adjunct Senior Lecturer, Dublin Institute of Technology, Dublin.

2011–2013: Senior Lecturer, Manchester Metropolitan University, UK

2010–2011: Lecturer, Manchester Metropolitan University, UK

2008–2010: Lecturer, University College Dublin, Ireland

2004–2006: Research Scientist, Indian Institute of Crop Processing Technology, India

Expertise

My primary research interests relate to novel food processing, extraction and preservation technologies, with a strong focus on investigation of biochemical and microbial kinetics in food and food products. I am particularly interested in the investigation of technological aspects (nutritional, microbial, enzymatic and chemical inactivation phenomena) in thermal and non-thermal processing studies.

A particular focus of my current research relates to the investigation of green and sustainable solutions to food industry challenges. In addition, I am interested in extraction technologies with particular reference to extraction of biomolecules from food processing by-products and waste streams

Selected Publications

1. Ojha, K. S., Mason, T. J., O'Donnell, C. P., Kerry, J. P., & Tiwari, B. K. (2017). Ultrasound technology for food fermentation applications. *Ultrasonics sonochemistry*. 34, 410–417.
2. Ojha, K. S., Kerry, J. P., Alvarez, C., Walsh, D., & Tiwari, B. K. (2016). Effect of high intensity ultrasound on the fermentation profile of Lactobacillus sakei in a meat model system. *Ultrasonics sonochemistry, 31*, 539–545.
3. Ojha, K. S., Alvarez, C., Kumar, P., O'Donnell, C. P., & Tiwari, B. K. (2016). Effect of enzymatic hydrolysis on the production of free amino acids from boarfish (Capros aper) using second order polynomial regression models. *LWT-Food Science and Technology, 68*, 470–476.
4. Ojha, K. S., Keenan, D. F., Bright, A., Kerry, J. P., & Tiwari, B. K. (2016). Ultrasound assisted diffusion of sodium salt replacer and effect on physicochemical properties of pork meat. *International Journal of Food Science & Technology, 51*(1), 37–45.
5. Hayes, M., & Tiwari, B. K. (2015). Bioactive Carbohydrates and Peptides in Foods: An Overview of Sources, Downstream Processing Steps and Associated Bioactivities. *International Journal of Molecular Sciences, 16*(9), 22485–22508.
6. Kadam, S. U., O'Donnell, C. P., Rai, D. K., Hossain, M. B., Burgess, C. M., Walsh, D., & Tiwari, B. K. (2015). Laminarin from irish brown seaweeds ascophyllum nodosum and laminaria hyperborea: Ultrasound assisted extraction, characterization and bioactivity. *Marine drugs, 13*(7), 4270–4280.
7. Tiwari, B. K. (2015). Ultrasound: A clean, green extraction technology. *TrAC Trends in Analytical Chemistry, 71*, 100–109.

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PROFILE

Dr. John Tobin

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Education

Ph.D. Food Science and Technology, University College Cork (UCC), Ireland. 2012

B.Sc. (Hons) Food Science and Technology, University College Cork. 2006

Career

2014–2015: Senior Process Technologist – Danone Nutricia Early Life Nutrition – Utrecht NL

2011–2013: Process Specialist – Danone Nutricia Early Life Nutrition – Utrecht NL

2009–2011: Research Officer – Teagasc Food Research Centre, Moorepark, Fermoy, Cork, Ireland

Expertise

My primary research interests include the links between dairy science, process technology and process engineering. Process technology platforms I am involved in include thermal processing, evaporation, spray drying, homogenisation, high shear technologies and separation/ fractionation technologies. In particular my primary areas of expertise revolve around the complete deconstruction of milk by filtration and separation technologies, coupled with mapping of the physical partition of milk components during fractionation. I am also extensively involved in thermal processing particularly relating to the controlled denaturation and aggregation of protein streams in both low and high dry matter environments. My experience in thermal processing covers both direct (PHE/THE) and indirect (steam injection/infusion) technologies and also delves into the stability and interactions of complex nutritional formulations within all facets of thermal and concentration processes.

Selected Publications

1. Tobin, J. T., Heffernan, S. P., Mulvihill, D. M., Huppertz, T., & Kelly, A. L. (2015). Applications of High-Pressure Homogenization and Microfluidization for Milk and Dairy Products. Emerging Dairy Processing Technologies: Opportunities for the Dairy Industry, 93.
2. Tobin, J. T., Fitzsimons, S. M., Chaurin, V., Kelly, A. L., & Fenelon, M. A. (2012). Thermodynamic incompatibility between denatured whey protein and konjac glucomannan. Food Hydrocolloids, 27, 1, 201–207.
3. Tobin, J. T., Fitzsimons, S. M., Kelly, A. L., & Fenelon, M. A. (2011). The effect of native and modified konjac on the physical attributes of pasteurized and UHT-treated skim milk. *International Dairy Journal*, 21, 790–797.
4. Tobin, J. T., Fitzsimons, S. M., Kelly, A. L., Kelly, P. M., Auty, M. A. E., & Fenelon, M. A. (2010). Microparticulation of mixtures of whey protein and inulin. *International Journal of Dairy Technology*, 63, 32–40.
5. Murphy, E. G., Tobin, J. T., Roos. Y. H., & Fenelon, M. A. (2013). A high-solids steam injection process for the manufacture of powdered infant milk formula Dairy Science & Technology 93, 463–475.

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PROFILE

Dr. Miriam Walsh

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Education

B.Sc. (Hons), Analytical Science, Dublin City University (DCU) 1992

Ph.D. (Chem), DCU, 1997

M.Sc. (Technology Management), UCD, 2005

Diploma in IP and Technology Law, 2014

Career

1996–1997: Assistant Lecturer, Dublin City University

1997–2000: Technical Support Chemist, Chemoran,

2001–2002: Technical Support, Unitech, Dublin

2003–2005: Programme Manager, Chemistry Dept., UCD

2005–2006: IP Officer, Trinity College Dublin

2006–Present: Teagasc Technology Transfer Office

Role and Responsibilities

Teagasc Technology Transfer Office (TTO), aims to be a conduit for technology transfer of Teagasc research outputs. From 2013, Teagasc TTO with UCC and Cork IT TTOs formed the UCT consortium, supported by Enterprise Ireland through Technology Transfer Strengthening Initiative (TTSI), whereby Teagasc TTO benefits from close partnership and experience of its partners to increase efficiencies in knowledge transfer.

As head of the Intellectual Property (IP) unit, my role involves working closely with the head of TTO, Declan Troy, to ensure an effective TTO through implementation of transparent and consistent policies and procedures for management of IP and technology transfer, in line with best practice and National IP policy.

We strive to facilitate the professional management of our research outputs through strategic management, by close alignment with our research and technology transfer strategic priorities and by evidence of impact on research community and related industry.

I manage the unit involved in negotiating research agreements emanating from formal links with Irish and international companies and peer research institutes, especially within agri-food space. This ranges from non-disclosure agreements, to collaboration and license agreements. This unit also manages Teagasc patent and IP portfolio, facilitating the licensing of such IP to industry and other end users. We also provide support and guidance to Teagasc staff in this area, including applying for commercially focused state funding. Other important responsibilities include close engagement with key stakeholders, including all funding agencies, Knowledge Transfer Ireland (KTI), the government, collaborating parties and tracking and reporting on the performance of Teagasc research directorate in terms of predefined metrics of technology transfer activities.

Teagasc uses a range of mechanisms in order to engage with industry/stakeholders at varying levels of complexity, ranging from consultancy provision and commercial services to large scale collaborations and licenses. While we use National IP protocol and template agreements to facilitate formalisation of such interactions, we are flexible in the specifics of the interaction and happy to discuss various options with each individual party.

Relevant Articles

1. “Harnessing the Power of IP”, TResearch, Vol. 2, No. 1, Spring 2007.
2. “Encouraging Innovation”, TResearch, vol 5, no.2, Summer 2010.
3. “Gateways to Technology Transfer”, TResearch, Vol. 7, No. 2, Summer 2012.

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Education

M.Sc. Education & Training Management, Dublin City University 2002.

M.Sc. Agricultural Chemistry, University College Dublin 1990.

B.Sc. Industrial Microbiology, University College Dublin 1986.

Career

2011–Present: Food Industry Development, Teagasc Food Research Centre, Ashtown.

2004–2010: European Commission Food & Veterinary Office.

1998–2004: Food Safety & Quality Consultant & Trainer, Teagasc Food Research Centre, Ashtown.

1994–1998: Quality/ Regulatory Affairs Manager, Medical Devices Industry.

1991–1994: Medical Devices Directorate, Department of Health (UK).

1990–1991: Irish Sea Fisheries Board (BIM).

Expertise

- Delivery of consultancy, auditing and training projects to food industry clients.
- Design & delivery of specialised training and events including microbiology, hygiene, HACCP, food standards development, auditing, food law, and labelling.
- Providing training to support change management and delivery to multi-cultural groups.
- Establishing and updating quality management systems.
- Auditing and developing internal audit procedures and systems.
- Addressing varied client queries in the area of food safety & quality including legislative compliance, standards requirements and product development.
- Initiating and organising multi-agency projects to better serve the food industry.
- Developing industry standards.

Selected Publications

1. White, I. (2014) Food Labelling & Allergen Awareness, T-Research Volume 9: Number 1, Spring 2014 pp30–31
2. White, I, (2013) Tips for Producers & Suppliers of Packaging to the Food Industry, The Irish Packaging Directory
3. White, I, (2012) Facing the Future for Food Labelling Laws, The Irish Packaging Directory, pp18–21
4. White, I. (2011) Package Your Way to New Markets, *T Research* Volume 6: Number 4, Winter 2011, pp 14–15
5. European Commission Decisions (2008/654/EC) (2007/363/EC) (2006/677/EC) relating to auditing, developing and reporting on multi-annual national control plans within Member States' Competent Authorities.


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