



**Expertise**

## Analytical Capabilities for Characterisation of Bioactive Compounds

The analytical capabilities at the Nutraceutical Research Facility at Teagasc Ashtown provide expertise and services in the structural elucidation and quantification of bioactive compounds from marine, meat and terrestrial plant sources. Expertise in fractionation and enrichment technologies of bioactive compounds that can serve as potential functional food ingredients is also available.

### Background

The Nutraceutical Research programme in Teagasc plays an important role in providing leadership in research, consultancy and support to Irish food industries in the area of functional foods. Identification of the bioactive components associated with the salutary health-effects and their quantifications are essential requisite to make health claims. Teagasc, with the generous funds largely from the Food Institutional Research Measure, has significant expertise and infrastructure in the area of bioactive component fractionation and characterisation.

### Benefits to Industry

EU 2006 regulations on nutrition and health require stringent criteria to qualify novel bioactive compounds for specific health-claims. The chemical structure of the food component(s) responsible for health-promoting attributes is one key criterion. For the food components that have already been approved by EFSA for specific health-claims, or those that have the potential to be approved, Teagasc provides services and expertise in recovery (enriched fractions) and characterisation, which can be incorporated into functional foods.

### Areas of Expertise

- polyphenols.
- glucosinolates.
- carotenoids & polyacetylenes.
- proteins & peptides.
- polyunsaturated fatty acids, sterols.
- polysaccharides (beta-glucans/chitosans).



### Facilities/Equipment

- Pilot-scale rotary evaporator.
- Flash Chromatography/Preparative Chromatography.
- MALDI-Q-ToF Mass Spectrometer.
- UPLC-TQD Mass Spectrometer.
- GC-MS.

### Of Interest to

- Food growers and processors.
- Ingredient companies.

### How to Proceed

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## Analysis of Food-derived Carbohydrates

Teagasc researchers can provide specialist know-how, facilities and services in carbohydrate chemistry of foods and ingredients. This includes the application of key novel technologies including high-performance anion exchange (HPAE) developed to separate carbohydrates. Coupled with pulsed amperometric detection (PAD), this permits direct quantification of non-derivatised carbohydrates at low-picomole levels with minimal sample preparation and clean-up. Researchers at Teagasc are available to carry out contract or collaborative research with companies in the aforementioned areas with a view to the exploitation of novel technologies for food and food ingredients.

### Background

Research on food derived carbohydrates or oligosaccharides has received much attention in recent years, and there is increasing evidence of the local effects of these carbohydrates (either in free form or when attached to proteins or lipids) within the gastrointestinal tract. Such effects may include prebiotic, anti-adhesive and anti-inflammatory activities, glycome modification, an influence on brain development and growth-related characteristics of intestinal cells and other, as yet uncharacterized, effects.

### Benefits to Industry

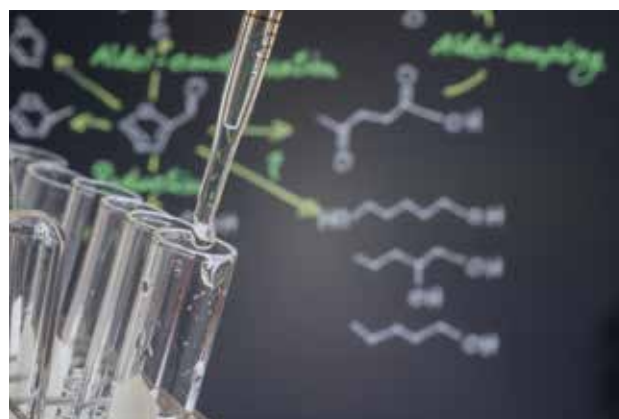
Teagasc have extensive carbohydrate chemistry capabilities and expertise. The Glyco-ingredients laboratory includes state of the art HPLC equipment with detection systems specifically tailored for the analysis of food-derived carbohydrates. These include a Dionex HPLC and a Waters HPLC with Refractive Index detector. For structural determination of unknown carbohydrates we work with our collaborators at NUIG.

### Areas of expertise

- Food oligosaccharides and glycoproteins – extraction, enrichment, fractionation and structural.
- Chromatography – Size-exclusion, Affinity and Ion Exchange Chromatography.
- Development of bioassays for investigating the bioactive properties of glycans isolated from food.

### Facilities/Equipment

- Dionex HPLC with pulsed amperometric detection
- Waters HPLC with refractive index detector
- Chromatography – size exclusion, affinity, ion exchange



### 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 ingredient companies

### How to Proceed

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## Compositional Analysis of Dairy Products

The Technical Services Laboratory at Teagasc provides chemical testing services to clients from the dairy industry worldwide. We have recently been awarded INAB accreditation in ISO17025 for chemical testing (fat, protein and moisture/total solids) of dairy powders and liquid dairy products. The techniques employed by the Technical Services Laboratory are the gold standard in wet chemistry. Our methods are based on the International Dairy Federation (IDF) reference methods which enables the delivery of accurate and quality results in a timely manner.

### Background

In order to deliver high quality products, dairy processors need to be able to deliver accurate and reliable test results. The Technical Services Laboratory in Moorepark has a long history of delivering results to clients in a friendly and efficient manner.

### Benefits to Industry

The Technical Services Laboratory can provide testing services to industry clients which are accredited to the international standard ISO17025. As well as our accredited tests, we offer a number of compositional analyses which may suit your needs including: ash, intact casein, D/L-lactic acid, non-casein nitrogen, non-protein nitrogen and amino acids. We also offer a subscription service to our weekly Milk Standards, which act as accurate reference points for creameries thereby ensuring correct payments to suppliers.

### Areas of Expertise

- Dairy chemistry.
- Wet chemistry techniques.
- International Dairy Federation techniques, specifically IDF 1, IDF 9, IDF20-3, IDF 20-4, IDF 29-1 and IDF 26.
- Milk analysis using Fourier-transform infrared spectroscopy (FTIR).
- Amino acid analysis using ion-exchange chromatography.

### Facilities/Equipment

- Kjeldahl digesters and 60 place automatic distiller.
- Jeol AminoTac amino acid analyser.
- Bentley DairySpec FT.
- Leco TGA gravimetric oven.
- Thermo Spectronic Genesis 2 UV-visible spectrophotometer.
- Gerhardt Soxtherm.



### Of Interest to

- Dairy and food industry.
- Ingredient and infant formula manufacturers.

### How to Proceed

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## Food Surfaces and Structure

Specialised knowledge, state-of-the-art facilities and services are available in Teagasc for the production and characterisation of food emulsions and foams using a range of advanced analytical techniques. Expertise includes the application of pendant drop tensiometry, emulsion particle size analysis and rheology to processing, storage and final product end-use. Knowledge of food ingredient surface activity can be successfully applied to improved formulation, stability, trouble-shooting and product development strategies. Work can be carried out as contract or collaborative research with companies.

### Background

Emulsions (mixtures of immiscible liquids) and foams play a significant role in the production, stability and quality of many food products. Examples of food emulsions include milk, infant milk formula, butter, mayonnaise and dressings. Such emulsions are inherently unstable and require a surface active material (such as milk proteins, phospholipids, monoglycerides etc.) to stabilise oil or water droplets. The physical properties of emulsions are determined largely by the nature of the interfacial layer formed at the surface of the droplets. Fundamental knowledge of such behaviours is critical to the production of emulsions, foams and surfaces in food.

### Benefits to Industry

- Characterisation of ingredient surface properties.
- Determination of emulsification, foaming and wetting properties.
- Effects of formulation and processing on the emulsion stability.
- Improved product quality and stability.

### Areas of Expertise

- Determination of droplet interfacial tension and surface pressure.
- Mechanical properties of emulsions and foams.
- Competitive surface active behaviour.
- Suitable for oil-in-water (o/w), water-in-oil (w/o), air-in-water (foams) and water/solids (redispersion/wettability of powders).

### Facilities/Equipment

- Pendant drop tensiometer.
- Particle size analysis.
- Emulsion/foam stability analysis.
- Dedicated rheology lab.
- Advanced imaging techniques.



### Range of Solutions

Various options by which companies can engage with Teagasc, include the provision of analytical services, through to contract or collaborative research.

### Of Interest to

- Food and ingredient companies.
- Academic and research organisations.

### How to Proceed

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## National Food Imaging Centre

Teagasc researchers provide specialist know-how, facilities and services in food nano- and micro-structure characterisation. The National Food Imaging Centre (NFIC) is a unique and powerful set of tools dedicated to the Irish agri-food sector. Researchers at the Teagasc Food Research Centre, Moorepark are available to perform contract or collaborative research with companies to identify and solve product quality issues and to help develop new products.

### Background

Microscopy often provides key information when troubleshooting existing food products or developing new ones. The NFIC is a major investment in state of the art imaging tools already extensively used by the food industry and other academic collaborators. The processability, texture, flavour and storage/shelf life of foods are controlled not just by chemical composition, but also by how the various ingredients are distributed and interact at the nano- and microscopic length scales. Food structures vary enormously from homogenous liquids to complex, multiphase solids containing fats, proteins, polysaccharides, salts and water in the form of fibres, droplets, crystals, glasses or networks. The size, shape and distribution of these structures greatly influence product stability as well as sensory properties and bioavailability.

### Benefits to Industry

Any food or beverage product can be examined quickly with minimal sample preparation. Typical applications include:

- Powders: morphology, occluded air, fat distribution, size, stickiness, surface features.
- Emulsions: stability – phase separation, protein aggregation, droplet sizing.
- Natural foods: fruit and vegetables, meat, fish;
- Processed foods: dairy (beverages, yogurt, cheese), meat products, bakery, confectionary, spreads.

### Areas of Expertise

- Nano/Microstructure analysis of a wide range of foods.
- Relating microstructure to process conditions and product quality.
- Solving product issues.
- Developing new food products.



### Facilities/Equipment

- Light microscopes, including high speed camera.
- Confocal scanning laser microscope.
- Scanning electron microscope (includes cryo-stage).
- Atomic force microscope.
- Image analysis.

### 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 processors.
- Ingredient companies.
- Food manufacturers across all sectors including dairy, cereals, meat, snacks, beverage, confectionery etc.

### How to Proceed

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## Process Analytical Technologies (PAT tools)

Teagasc researchers can provide specialist know-how and facilities in process analytical technologies (PAT tools). This includes the application of key PAT tools that meet industrial standards such as European Hygienic Engineering and Design Group (EHEDG). We also have expert knowledge and experience in the implementation of PAT sensors, for improving process control and quality i.e. through the use of inline/at-line multivariate flow and viscosity meters. Researchers at Teagasc Moorepark are available to carry out contract or collaborative research with companies in the aforementioned areas with a view to exploiting PAT tools to maximise process efficiencies.

### Background

The food industry has always been at the forefront in assessing the potential that new processing analytical technologies (PAT) can offer. PAT is any strategy, method or instrument that maximises efficiencies within a process and has been widely adopted in other industries e.g. the pharmaceutical and chemical industries. Implementation of PAT tools into a process is part of the wider “quality by design” framework. The adoption of cost effective, retrofittable, robust and sanitary PAT tools which offer tangible gains from process efficiencies are currently under-utilised in the dairy industry. The benefits of PAT include increased process and product understanding, by monitoring and control of the major steps in a dairy process.

### Benefits to Industry

A range of PAT tools are available in Moorepark, which can be utilised on a laboratory or pilot scale using purpose built test skids and rigs. Incorporation of such PAT tools into commercial scale processes allow for greater control and monitor of dairy concentrates, hence generating process efficiencies.

### Areas of Expertise

- Evaluation and validation of process analytical technologies (viscosity, flow, pressure).
- Rheological testing of dairy concentrate behaviour.
- Testing of heat-induced protein structural changes.

### Facilities/Equipment

- Promass I300 (Endress + Hauser -Viscometer & Flowmeter).
- Portable purpose built test skids with a small footprint.
- FloWave (Burkert) (multivariate flowmeter).
- Vismart (Sengenuity) – viscosity sensor.
- Laboratory scale test rigs.



### 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.
- Ingredient and Infant Formula Manufacturers.

### How to Proceed

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## High Protein Powder Characterisation

Teagasc combines 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 membrane filtration and spray drying technology. This extends from powders for dairy applications to nutritional formulations, with Teagasc consistently supporting a drive for research that meets client expectations, particularly around areas such as increasing high protein powder solubility through the use of novel and innovative techniques.

### Background

High protein powders are used both domestically and globally for protein standardization in fat-filled products, yogurts, therapeutic beverages and in infant milk formulas. However, while issues such as protein denaturation/aggregation and viscosity are challenges during in-process high protein ingredient manufacture, one of the most significant challenges is the subsequent rehydration of these powders. Without proper hydration and complete solubility, the functionality of these protein ingredients is dramatically decreased.

### Benefits to Industry

Teagasc Moorepark and Moorepark Technology Limited have pilot plant facilities from laboratory to semi-commercial scale allowing for research to be performed from raw milk intake all the way to the development of high protein liquid streams using membrane filtration and subsequent powder production. The benefit of such facilities allows users to tap into the existing knowledge base at Teagasc and carry out novel and exciting research in areas applicable to them. The benefit to the client also comes from the ability to use advanced methodologies and techniques for analysing powder wettability, dispersability, sinkability and solubility.

### Areas of Expertise

- High protein ingredient manufacture.
- Protein denaturation/aggregation kinetics.
- Powder Hydration.
- Ultrasound assisted powder hydration.
- Mineral chelating interactions.
- Infant milk formulation design and processing.

### Facilities/Pilot Equipment

- GEA multi-membrane pilot scale.
- Y-Tron high shear mixer.



- Cavitation Pump.
- Microthermics Tubular Heat Exchanger.
- Pilot scale Homogenizer (Niro).
- Multiple evaporation and spray drying options.
- Malvern Particle Size Analyser.
- Malvern Morphology unit.
- Surface Tension.
- Pycnometer.
- Microscopy (light, confocal and scanning electron microscopy).

### 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 ingredient and infant formula companies

### How to Proceed

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## Elemental Analysis of Dairy Products

Teagasc provides elemental analysis for a variety of dairy products (both liquid and powdered dairy samples). Scientists at Teagasc are available for contract analysis of routine and non-routine samples using a number of advanced methodologies including Inductively coupled plasma mass spectrometry (ICP-MS) and X-ray fluorescence (XRF).

### Background

Minerals are inorganic substances required by the body in small amounts for a variety of functions. These include the formation of bones and teeth; as essential constituents of body fluids and tissues; as components of enzyme systems and for normal nerve function. Minerals are often absorbed more efficiently by the body if supplied in foods rather than as supplements. Milk and dairy products are an important source of dietary minerals.

### Benefits to Industry

An understanding of the role of charged ions is important from the perspective of the food processor as the mineral content can have a key determining role in the physicochemical properties of foods, including aggregation and heat stability of food stuffs and, in particular, infant formula. It is also important to be able to support label claims, from the perspectives of nutrition and toxicity.

### Areas of Expertise

Inductively-coupled optical emission mass spectrometry (ICPOES), Inductively-coupled plasma mass spectrometry (ICPMS) and X-ray fluorescence (XRF) are now well-established methods for basic analysis. The purchase of an ICP-MS system at Teagasc has enhanced our ability to investigate the complex role played by minerals in both the processing and nutritive properties of foods. This technology advances our knowledge on the key role played by many of the counter ions present in dairy products. Teagasc also has expertise in XRF methods which can be applied to analyse solid, liquid, and thin-film samples for both major and trace (ppm-level) components. The analysis is rapid and usually sample preparation is minimal or not required at all.



### Facilities/Equipment

- ICP-MS analysis of dairy products.
- XRF and Ion chromatographic analysis.
- Atomic absorption spectroscopy of cheese samples.
- Use of classical methods such as titration and spectrophotometric methods for powders and cheeses.

### Range of Solutions

Companies can engage with Teagasc to find technical solutions to problems either as contract work or as part of collaborative research.

### Of Interest to

Food and ingredient companies

### How to Proceed

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## 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, process technologies increased valorisation and non-invasive predictive 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 through DAFM, various agencies and industry collaborations 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 collaborative projects or 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.
- Ingredient innovations and clean-label processed meat.
- Interventions for improved quality in primary processing.
- Predictive technologies for quality assessment.

### Facilities/Equipment

- Slaughtering/boning.
- Meat processing and cooking.
- Packaging.
- Chilling and freezing.
- Analytical (incl. GC, NMR, oxidative status, texture analysis, yield studies, colour analysis).
- 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.

### How to Proceed

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## 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 incl. mixers and tall-form spray drier.
- Separation, concentration, homogenisation and heating systems.
- Analytical capability incl. 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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## 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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## 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.

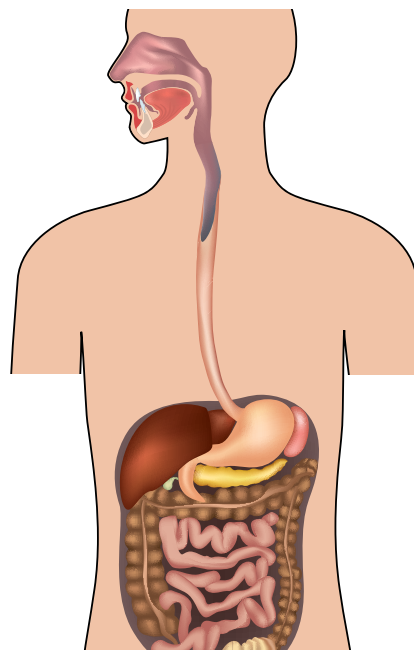
### Areas of Expertise

- 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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## Food BioTest Capabilities

The prevalence of major diseases such as obesity, diabetes, sarcopenia 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 manufacturers

### How to Proceed

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## 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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## 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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## 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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