

Research programme 2018



With industry,
for industry

Research Programme 2018

©Campden BRI 2018

Station Road, Chipping Campden, Gloucestershire, GL55 6LD. UK
Tel: +44(0)1386 842000

www.campdenbri.co.uk

Information emanating from this company is given after the exercise of all reasonable care and skill in its compilation, preparation and issue, but is provided without liability in its application and use.

Legislation changes frequently. It is essential to confirm that legislation cited in this publication and current at time of printing, is still in force before acting upon it.

The information contained in this publication may not be reproduced without permission from the Editorial Manager.

Introduction

The Research Programme 2018 lists all research and development projects, other than small service contracts and confidential consortia or company-funded work, currently being undertaken by Campden BRI.

Projects are grouped by industry driver. These are drawn from the Scientific and Technical Needs of the Food and Drink Supply Chain – the result of a triennial industry-consultation exercise we undertake. This emphasis on industrial relevance is reinforced by the active involvement of members in the creation, selection and steering of many of the research projects in this document. As a consequence, the results of the research programme have considerable commercial relevance.

For each project, a concise description is presented together with details of the funding source, start and end dates, collaborators, and project manager, who will be pleased to provide further information about their projects.

The commercial implications arising from each project are reported to members by a variety of routes:

- Each Member Funded Project has its own website
- Regular progress reports and presentations to Member Interest Groups, in our newsletter, and through podcasts, videos, blogs and trade journal articles
- At appropriate stages during a project, Research Summary Sheets are produced and made available to all members via the website
- Reports are also made in greater depth through one or more of our regular series of publications such as R&D Reports which present detailed accounts of individual projects

Further details can be found on our website (www.campdenbri.co.uk) or from information@campdenbri.co.uk

Contents

Drivers/themes

Safety	1
Quality and value	6
Nutrition, health and well-being	16
Sustainability, resilience and food security	22
Skills and knowledge	25
Projects completed in 2017	29
Funding body abbreviations	32

Safety

Next generation methods for microbiological and chemical food safety

Campden BRI project 144029 (Jan 2018 – Dec 2020)
Member funded

Advances in analytical technologies have resulted in continued development of faster more efficient analytical methods. These allow us either to test more rapidly, with more certainty, or to test for hazards that we have never yet been able to detect. Such methods often come with little real world information or validation data. This project enables a very rapid response to be made to a need for new tests (when a new hazard emerges), or to quickly provide useful information on the practicality of new test systems coming onto the market. The project will assess next generation technologies in microbiological and chemical analysis, enabling access to rapid effective monitoring of food hazards and spoilage issues through novel/improved testing protocols.

Suzanne Jordan +44(0)1386 842013 suzanne.jordan@campdenbri.co.uk

Rapid methods for hygiene determination

Campden BRI project 144027 (Jan 2018 – Dec 2019)
Member funded

Many rapid hygiene test systems are already on the market, but limited independent assessment has been carried out to understand their capability and suitability to different environments, contaminant types and production technologies. Systems with the potential for providing an array of real-time information are also starting to appear in the food market, some of them not fully explored yet. Examples include rapid microbial indication, allergen surface residue, DNA detection methods and sensor technologies as ways to indicate or control contamination. The research will look mostly at non-microbiological methodology for identifying hazards present and compare these with known and validated methods that are currently used but take longer. The project will provide members with factual information on how well different rapid methods for testing cleanliness work in real industrial situations.

Craig Leadley +44(0)1386 842059 craig.leadley@campdenbri.co.uk

Food safety and traceability using protein profiling

Campden BRI project 140913 (Jan 2017 – Dec 2019)
Member funded

Mass spectrometry is widely used in pharmaceutical and food applications, the latter including complex matrices. Proteins and their peptide derivatives are responsible for food allergy, food functionality, nutritional properties (e.g. satiety) and food structure. They can also be used for 'fingerprinting' of foods. The approach could lead to reliable food safety applications, food fraud control, enhanced product development and efficient nutritional applications. This project will develop confirmatory methods for food allergen testing and the detection of the allergen source, multi-allergen testing methods, and protocols for handling difficult matrices in allergen testing and for the detection and the quantification of selected peptides/proteins.

Reka Haraszi +44(0)1386 842240 reka.haraszi@campdenbri.co.uk

Hygienic design: retrospective modification of existing plant

Campden BRI project 140912 (Jan 2017 – Dec 2018)
Member funded

Building and equipment modifications can be very invasive. They sometimes need to be carried out whilst other parts of the building are continuing to operate. Modifications can increase food safety risks and, if not properly managed or understood, will remain untackled until product failure. Food safety related issues relating to the modification will be identified and options for their control identified. This project will create impartial guidelines for carrying out changes in an existing plant, ensuring that hygiene considerations influencing food safety risks are known and correctly managed.

Andrew Bosman +44(0)1386 842471 andrew.bosman@campdenbri.co.uk

BirdEase: an integrated diagnostic system for bacterial detection in poultry farms

Campden BRI project 140724
A collaborative project funded by Innovate UK

The BirdEase Project, now in its second year, is developing an acousto-optic sensor system for use on farm to detect bacterial activity. Early indications are that the system can successfully discriminate between the important species of concern. However, it remains to be seen if different strains can be detected and identified. A prototype machine is being designed to accept contaminated boot covers on farm and output a report on the level and type of bacteria found in the sample. The system will include

remote access for data collection, software upgrades and technical support. Field trials of the prototype system will be undertaken on commercial farms during 2018.

Jeremy Davies +44(0)1386 842255 jeremy.davies@campdenbri.co.uk

PouLLS: environmental indicator and animal welfare monitoring sensory system

Campden BRI project

A collaborative project funded by Innovate UK

Poultry Livestock Sensor System (PouLSS) is a collaborative research and development project with the ambitious aim of creating an integrated platform that measures the environmental and welfare parameters in real-time and provides predictive algorithms that enable global broiler producers to: Improve productivity by identifying early warning signs and possible farm management intervention; demonstrate welfare standards have been satisfied; and benchmark houses, farms and sites globally identifying improvements and best practice.

The research is showing very positive results in relating distressed calls to both individual growth rate and the impact on neighbouring birds in a flock. The project culminates in 2018 with the launch of a cloud-based sensor system coupled with their inductive power supply.

Jeremy Davies +44(0)1386 842255 jeremy.davies@campdenbri.co.uk

Reducing waste and improving quality in the food supply chain using cold plasma technology as a last decontamination hurdle on the food production line

Campden BRI project 138773 (Aug 2015 – Jul 2018)

Funded by Innovate UK

Cold plasma is an exciting new technology with a proven potential for rapid microbial decontamination of surfaces. A plasma state is generated by applying a high voltage to a gas, transforming it into a cocktail of reactive plasma species, which may have high oxidation potential and therefore considerable food decontamination potential. Prepared produce decontamination is necessary to remove soil, foreign bodies and bacteria (potentially pathogenic) from the food surface but is notoriously difficult to achieve. Moreover, the different decontamination techniques used so far (e.g. chlorination, rapid chilling) are applied on the product before it is packed, meaning that recontamination can occur from further handling prior to packing. This project is using a novel pulsed plasma system to inject plasma species into the food packaging at the point of sealing, thus

providing a final decontamination hurdle directly in the pack without further recontamination risk. The objectives of the project are to prove this concept and demonstrate the improved shelf life and safety of a variety of food products (prepared salads, prepared fruit, prepared vegetables).

Danny Bayliss +44(0)1386 842130 danny.bayliss@campdenbri.co.uk

Ensuring the chemical safety of food and drink using non-targeted screening methods

Campden BRI project 138056 (Jan 2016 – Dec 2018)
Member funded

A key requirement for ensuring the safety of food is confidence in its origin and the integrity of its supply chain. An example which illustrates this is the alleged contamination of spices with nut residues, resulting in a costly recall to prevent potentially fatal consequences. In the Elliot Report, one of the recommendations for food companies was continued surveillance in order to detect fraud incidents at an early stage. This would provide protection for both food companies (who would lose brand integrity) and consumers. The requirements have been further reinforced by the inclusion in BRCv7 of a need to risk assess and possibly test for authenticity of raw materials. The problem facing many companies is that to be effective in detecting fraudulent activity, a company needs to know what to look for in the material concerned. The project will enable the development of applications for non-targeted screening using a range of techniques.

Danielle Cawdron +44(0)1386 842022 danielle.cawdron@campdenbri.co.uk

Risk reduction strategies for chemical contaminants in primary production

Campden BRI project 138054 (Jan 2016 – Dec 2018)

Member funded

Risks to human health associated with chemical contaminants in the food and feed chain need to be managed, as they can have a direct or indirect impact as hazards to human health. These hazards may arise from the natural environment or from inputs applied at the stage of primary production or during further processing. The control of contaminants in staple foods is especially important given their major contribution to the human diet. This project will help members understand where chemical contaminants originate from and the route by which they contaminate food products during primary production. Factors affecting levels of chemical contaminants in food products are likely to include: growing site history, source of fertiliser/organic manure, soil pH, irrigation water and varietal choice. Guidance will be produced to help members to minimise contaminant levels through agronomic interventions, selection of growing sites and cultivar choice.

Nick Saunders +44(0)1386 842162 nick.saunders@campdenbri.co.uk

Quality and value

Functionality of novel ingredients from natural sources

Campden BRI project 144034 (Jan 2018 – Dec 2020)
Member funded

Many functions in processed foods are performed by chemically synthesised materials. However, there are numerous cereals and plants that are known to contain elevated levels of active components that may well show specific functionality in the processing of foods. Applications could include foaming, emulsifying, rheology modifiers and water-binding agents. This project will assess the performance of selected food ingredients. Potential functions of interest will be examined in the processing of specific products and evaluated against existing additives with similar functional properties, providing practical information on the functionality and application to food systems of the most promising natural materials.

Sarab Sahi + 44(0)1386 842140 sarab.sahi@campdenbri.co.uk

Novel natural preservative systems for use in drinks, sauces and other high a_w foods

Campden BRI project 144033 (Jan 2018 – Dec 2020)
Member funded

The food and drinks industry is under pressure to use clean label preservatives as an alternative to traditional preservatives. At present very few effective natural preservatives are permitted for use. In addition, many manufacturers of products currently stabilised by high levels of thermal processing are looking for natural preservation systems that will reduce energy costs, avoid flavour deterioration, help maintain heat labile nutrients, and permit a wider range of packaging options. This project will practically assess potential novel preservatives to understand efficacy and whether other processing steps are needed to ensure their effectiveness in extending shelf-life. This project will also produce a toolbox of natural preservatives for clean labelling.

Greg Rachon +44(0)1737 824298 grzegorz.rachon@campdenbri.co.uk

Design and modelling of the impact of food structure on food texture

Campden BRI project 144032 (Jan 2018 – Dec 2020)
Member funded

Texture is an important sensory characteristic of many food products. Developing or reformulating products typically requires production and evaluation of many process and recipe variations to identify those that have the required structure and texture. This can be time consuming, involving use of costly pilot production facilities and sensory panels. This project will develop an improved capability to design products with the required texture by modelling the effects of differences in structure, and understand how process conditions can be used to create the required structure for a range of product types. It will demonstrate these capabilities through case studies, evaluate the effect of reformulation on texture and establish computer modelling facilities and expertise.

Martin Whitworth +44(0)1386 842139 martin.whitworth@campdenbri.co.uk

Microbiological shelf life testing – new approaches

Campden BRI project 144031 (Jan 2018 – Dec 2020)
Member funded

Establishing an accurate shelf life is key to a product's success. The shelf life should be sufficient to allow the product to be economically viable and minimise waste whilst maintaining key sensory, chemical and microbiological characteristics. It is therefore vital that the correct procedure is used when assessing shelf life. This project aims to reconsider the methods and procedures used to define microbiological shelf life (through setting up working groups comprising of members from producers, retailers and, potentially, government bodies), conduct practical studies to define the best practice approaches and recommendations, and then to update Campden BRI's guideline no.46 on the evaluation of product shelf life for chilled foods.

Linda Everis + 44(0)1386 842063 linda.everis@campdenbri.co.uk

Inactivation of bacterial biofilms – new approaches

Campden BRI project 144030 (Jan 2018 – Dec 2020)
Member funded

Bacterial biofilms pose a constant threat to the quality of a wide variety of foods. Organisms existing in a biofilm state are able to resist a number of microbiological measures to a greater degree than planktonic cells, leading to persistent challenge to cleaning and CIP systems. The aim of this project is to define the resistance of key

spoilage organisms in their biofilm state in order to establish and optimise procedures for decontamination and / or removal of biofilms in food industry settings.

Robert Limburn + 44(0)1386 842493 rob.limburn@campdenbri.co.uk

Innovatively improving the food safety and quality of sprouted grain bakery products

Campden BRI Project 142872
Funded by Innovate UK

Everfresh is a market leader in the emerging market for long-life sprouted grain bread and cakes. In the proposed project, it will work with its consortium of industry and research partners to develop an industry-leading approach for the production of sprouted grain bakery products.

Gary Tucker +44(0)1386 8420335 gary.tucker@campdenbri.co.uk

Extraction and purification of calystegines and iminosugars for use as natural preservatives

Campden BRI Project 142870
Funded by Innovate UK

Natural food preservatives to extend the shelf life of processed foods are increasingly important in the provision of food safety in sugar and salt limited recipes. Calystegines and iminosugars are valuable compounds which have been shown to provide a natural preservative function in chilled foods. These occur naturally in the Solanaceae family, which includes potatoes, and offer a new source of natural preservatives.

Gary Tucker +44(0)1386 8420335 gary.tucker@campdenbri.co.uk

Feasibility of a novel food preservation system

Campden BRI project 142817

Funded by Innovate UK

Modern Baker is a rapidly growing UK food manufacturer and retailer specialising in long-fermented and baked foods. Its ambition is to disrupt the baking industry and to redefine the market. The proposed project seeks to use cutting edge food science to naturally improve product shelf life.

Mike Adams +44(0)1386 842284 michael.adams@campdenbri.co.uk

Thermal processing of bakery products in baby and children's food

Campden BRI project 142715

Funded by Innovate UK

Pipkin and Moo is a new baby food business looking to revolutionise the baby food industry with an exciting and innovative new product range. The proposed project seeks to harness recent technological advances to drive product development and accelerate Pipkin and Moo's market entry.

Mike Adams +44(0)1386 842284 michael.adams@campdenbri.co.uk

“Shelf-Life Plus”: enhanced shelf-life evaluation using microbial profiling

Campden BRI Project 140910 (Jan 2017 – Dec 2019)
Member funded

All foods in the retail sector need to have a date of durability to mark the end of their shelf-life - the point at which levels of microorganisms, or biochemical and sensory markers meet predetermined targets. For microbiological shelf-life, these targets are limited to a few select species or groups of microorganisms that are listed in microbiological criteria and are organisms for which there are established agar based methods. However, other, less easy to detect but potentially important microbial groups which may have a large impact on the consumer acceptability characteristics of a food will never be observed. Microbiological shelf-life of products is currently determined by culture methods which introduce bias through culture medium selectivity and the organisms that can be targeted. Modern molecular methods (e.g. gene sequencing) could provide a more holistic approach to profiling microbial populations, and so more meaningful shelf-life determinations.

Greg Jones +44(0)1386 842143 greg.jones@campdenbri.co.uk

Quality and safety of cereal-based products and ingredients for the food and brewing industry

Campden BRI Project 140909 (Jan 2017 – Dec 2019)
Member funded

The quality and safety of cereal-based raw materials, ingredients and products is crucial to the cereal, baking and brewing sectors as well as many others. Analytical methods are a critical component of assuring quality and safety, and their development, trialling, standardisation and validation is a vital part of this. Cereals such as barley, oats and wheat are used in a wide range of products. They may be processed into the main ingredient (e.g. as malt, flour) in products such as beer, breads, biscuits, tortillas and many others or as a more minor ingredient in products such as soups, drinks, batter, and crumb coated foods. The quality and safety of cereals is of great importance to the relevant supply chains in particular since some of the cereal quality parameters have a direct influence on functionality and processing. This project will evaluate and make available a range of core analytical methods for cereals-based materials.

Clothilde Baker +44(0)1386 842287 clothilde.baker@campdenbri.co.uk

Process manufacturing of functional food particles from lignin-rich feed

Campden BRI project 140673 (Aug 2016 – July 2019)
EPSRC Studentship at the University of Nottingham

By-products of various manufacturing processes are a wide-scale problem facing the food sector. Lignin as a material is a major constituent of plant cell walls and previous research at the University of Nottingham has highlighted the role of lignin as a surface active constituent to stabilise food emulsions and foams. This research will investigate process-based modification of lignin-rich feed material into functional food particles through the use of thermal processing and microwave processing as key modification processes. Different lignin-rich waste materials will be utilised and the impact of the process parameters linked with the material on the functionality of the product will be quantified for use as an emulsifier.

Andrew Bosman +44(0)1386 842471 andrew.bosman@campdenbri.co.uk

Developing an understanding and improved sensory quality of low alcohol beer

Campden BRI project 140573
Studentship at the University of Nottingham

This project aims to create the framework of knowledge that might enable the production of a 5% beer and 0.1% beer in which consumers cannot perceive a difference. This will be done through gaining an understanding of drivers of liking and disliking for consumers in terms of low/non-alcoholic beer; explaining the consequence of dialysis for dealcoholisation on the chemical profile (aroma and taste) of low alcohol beer/ alcohol free beer; correlating changes in flavour compounds with changes in sensory properties developing an understanding of the temporal changes in sensory perception of dialysis based low alcohol/ alcohol free beer and; correlating temporal changes in sensory perception with aroma and taste compound delivery kinetics in-mouth. The project will also seek to understand consumer's emotions and perceptions of low/non-alcoholic beer. The outcome of this project will be the proposal of routes to optimise 0.1% beer, and increase parity of 0.1% beer to 5% beer.

Javier Gomez-Lopez +44(0)1737 824276 javier.gomez-lopez@campdenbri.co.uk

SweetVeg: Improving the yield of sweet corn and tomatoes: compliance with food manufacturers' requirements through the application of precision agriculture

Campden BRI Hungary Project (Aug 2016 - Jul 2018)
Funded by EUREKA

Sweet corn and tomato are important vegetable crops, in Hungary and Portugal respectively, for the freezing and canning industry. The global competitiveness of the products could be increased by improving product yield and sensory characteristics, and reducing raw material product defects. These are significantly influenced by soil parameters (moisture, nutrient availability, and micro and macro elements). SweetVeg will develop a sensor system which will monitor the above mentioned attributes along with crop development. Data collected from 3 years of cultivation will be used to set up models for both sweet corn and tomato crops to optimise supply of soil moisture/irrigation, nutrients, trace elements and other parameters necessary to produce sweet corn and tomatoes that meets the requirements of vegetable processor specifications on sensory properties and product defects.

Attila Berczeli +36 1 433 14 70 a.berczeli@campdenkht.com

Low protein wheat

Campden BRI project 139362
Funded by BBSRC

This project will facilitate the development of new types of wheat, with good breadmaking properties, at low grain protein (with fertilisation at the level required for the optimum yield). The project will also develop the use of selected current cultivars at lower protein contents than are currently required. This will be achieved by evaluating the performance of wheat lines selected for dough strength and stability at low protein content, developing new methods to determine quality at lower grain protein contents, establishing genetic markers for breeding for 'low protein' breadmaking wheat and providing new material to millers and bakers to enable them to optimise their processing conditions

Clothilde Baker +44(0)1386 842287 clothilde.baker@campdenbri.co.uk

Extension of product shelf life through superchilling

Campden BRI Project 138069 (Jan 2016 – Dec 2018)

Member funded

The term 'superchill' is used to define the temperature at which a product starts to freeze, generally around -2°C. At this temperature, some of the product is ice and some contains liquid water. This partial freezing dramatically reduces the rate of appearance of microbiological and chemical spoilage defects, and allows a long shelf life to be achieved compared to the conventionally chilled product (>3°C to 8°C). The main findings from a Defra-LINK funded research project into storage of food at 'superchill' temperatures were that some foods can be stored at approximately -2°C for an extended period of time before being released into the chill chain, with minimal impact on either microbiological or sensory shelf life. The range of products to be tested in this project is based on those that indicated the greatest extension of shelf life in the Defra project, but extending that range to give manufacturers/retailers clear evidence of products that would gain most benefit from use of superchilling, and what that benefit would be in terms of life extension. The project will also examine the use of superchilling as a single hurdle in a multiple hurdles system, in order to establish if longer life extensions could be obtained within such systems.

Greg Jones +44(0)1386 842143 greg.jones@campdenbri.co.uk

Emerging ingredients – considerations for use in products

Campden BRI Project 138058 (Jan 2016 – Dec 2018)

Member funded

For the food and drink industry to remain innovative and competitive it is essential to be aware of emerging ingredients to allow market differentiation. In addition there is also a need to identify new solutions for delivering nutritious products that meet dietary needs or to reformulate to remove allergens (e.g. dairy or gluten free). However, as new ingredients emerge into the market, or enter from other sectors such as Asia and the US or from different product applications, there is a need for clear information on if and how they can be used in specific products. This project will address the industry need for anticipating and responding to regulatory and technical changes such as approval of new ingredients or approval for existing ingredients to be used in new categories. The overarching aim of this new project is to provide members with information on a wide range of ingredients emerging worldwide and provide information on their potential use. The project will consist of a mixture of desk-based work, analytical testing and practical trials (bench-scale development and small scale feasibility trials) to evaluate how ingredients perform within a range of systems.

Rachel Gwinn +44(0)1386 842034 rachel.gwinn@campdenbri.co.uk

New technologies for food and drink manufacturing

Campden BRI Project 138057 (Jan 2016 – Dec 2018)
Member funded

The 'new technologies' project has been running in various forms since 1990. The current project consists of a blend of desk based research to produce information bulletins, and practical 'proof of principle' evaluations of new technologies carried out with a view to identifying areas for more detailed research. The project will follow this similar structure with some modifications to the delivery of the content. The focus for the project for this funding period will be on emerging technologies for improving quality and value. Shelf life is not always determined by microbial growth so understanding the impacts that new technologies have on preserving important quality parameters is an important area. The feasibility studies selected for inclusion in the project have historically been medium to long term technologies in terms of commercial uptake. Such technologies will continue to feature in the programme, but there will also be a shift to include nearer market new technologies.

Danny Bayliss +44(0)1386 842130 danny.bayliss@campdenbri.co.uk

To develop sustainable approaches to improve grain quality and help end users of soft wheat to mitigate challenges in downstream processing

Campden BRI project 136396
Funded by Innovate UK

Users of soft wheat have identified variation in quality to be a major root cause of challenges encountered in downstream processing. These challenges are currently managed reactively, and are exacerbated by a fundamental lack of understanding in terms of defining the principal quality characteristics of soft wheat for a given process.

This project will address this challenge by identifying desirable quality characteristics, developing analytical tests to allow screening of soft wheat lines, and finally testing the stability of these characteristics in the context of variation according to growing environment and year. This will enable a new pipeline of quality soft wheat varieties in the UK, less reliance on wheat imports, and a reduction in downtime and use of processing aids in downstream manufacturing.

Joe McGurk+44(0)1386 842241 joe.mcgurk@campdenbri.co.uk

In-pack ohmic food processing

Campden BRI project 136191 (Jan 2015 – Dec 2018)

Funded by Innovate UK

The principle objectives of the in-pack ohmic heating project are to confirm the effectiveness of pasteurising, using ohmic heating techniques, to achieve enhanced food quality and safety from this rapid, gentle heating technique, and to confirm that the concept would be capable of scale-up to an industrial context. This work is being done in collaboration with C-Tech Innovation.

Craig Leadley +44(0)1386 842059 craig.leadley@campdenbri.co.uk

Nutrition, health and well-being

Clean label sugar reduction

Campden BRI project 144037 (Jan 2018 – Dec 2020)
Member funded

Current and impending PHE targets, the sugar levy, demands from consumers and social responsibility means there is a huge pressure for the food industry to continue carrying out wide ranging reformulation. This presents a major technical challenge to the food industry.

A lot of focus in recent years has been on identifying suitable alternative ingredients for sugar reduction, however, these are not always well accepted by consumers, who are increasingly demanding clean label solutions. This project aims to take an alternative approach by understanding how far sugar can be simply removed before product quality is compromised to an unacceptable level or functionality is lost and the need arises to intervene via the use of clean label and/or processing solutions to optimise the level of reduction that can be achieved. The project will also explore what is the smallest portion size consumers will accept before they buy two of the same product and the effectiveness of two clean label approaches in composite products.

Charlotte Holmes +44(0)1386 842257 charlotte.holmes@campdenbri.co.uk

Iron and zinc bioavailability

Campden BRI project
Funded by BBSRC

Nutritional deficiency in essential dietary metals such as iron and zinc is a public health concern in the UK, particularly for girls and young women. Approximately 30 - 50% of the iron and zinc in the UK diet is provided by cereals and cereal. In wholegrain wheat, most of the iron and zinc is contained within a single layer of cells called the aleurone layer. However, recent work shows that aleurone cells are resistant to physical disruption and digestion. Additionally, the aleurone layer is removed during processing of wheat into white flour and hence much of the iron and zinc is lost.

This project aims to use novel food processing techniques to increase the bioavailability of the naturally-occurring iron and zinc in wheat. This process, called micro-milling, ruptures the aleurone cell walls and potentially makes the iron and zinc more available for absorption. Recently published work shows that micro-milling increases the solubility of iron and enhances iron absorption by intestinal epithelial cells. We will test the

bioavailability of zinc and iron in micro-milled wheat and analyse the structure of breads produced to assess the consumer acceptability of these products.

Simon Penson +44(0)1386 842280 simon.penson@campdenbri.co.uk

Protein for life

Campden BRI project 142782

Funded by BBSRC

People in western society are living a lot longer, and 'ageing well' is now becoming a very important priority for public health. Ageing goes hand in hand with a loss of muscle size and strength (known as sarcopenia). Physical inactivity and poor nutrition are known to speed up the loss of muscle size and strength. A lack of protein is a key dietary deficiency for the ageing population. Food intake is known to decline with age. This is due to a range of factors including loss of appetite, changes in perceptions and taste, living conditions and financial reasons. There is currently a lack of mainstream food products that can help meet the protein needs of an ageing population. This project will attempt to identify and develop guidelines for protein products for healthy ageing that are sustainable, cost effective and enjoyable. This information will then inform the food industry for new product development and reformulation of existing products that are appropriate.

Joe McGurk +44(0)1386 842241 joe.mcgurk@campdenbri.co.uk

Profitable industrial manufacturing of bread for the retail mainstream with enhanced nutritional composition

Campden BRI Hungary project (Oct 2017 – 2019)

Government funded

Semi-white and wholemeal breads with focus on improved nutritional profile for a healthy diet will be developed. Cost premium associated with the use of more expensive ingredients will be balanced through the savings on the manufacturing cost. Improvements in line performance and energy use would be achieved with better process control on the critical equipment, all this through the set of intelligent sensors driven closed control loops. Higher added value and bakery products shall not necessarily be more expensive on the shelves if produced in high volume, on an efficient line, making the benefits widely available to those wanting the health conscious choice.

András Sebők +36 1 433 14 70 a.sebok@campdenkht.com

Ingredient selection to meet compositional and nutritional targets

Campden BRI project 140908 (Jan 2017 – Dec 2019)

Member funded

Food and beverage product formulation / ingredient selection is being driven to meet an increasing number of compositional (and hence nutritional) goals by a range of factors, including consumer demand. This process is often technically complex due to the large and increasing number of variables involved – but necessary in the context of nutrition claims and wider corporate social responsibilities. Food retailers and manufacturers are driven to improve the nutritional composition of their products by the need to acknowledge consumer perception of nutritional requirements, the potential to make nutrition and health claims, and increasingly by corporate social responsibility. The final point is becoming increasingly relevant, as UK and European food supply is not fully meeting the nutritional requirements of the public. This project will develop a database tool to guide ingredient selection during formulation against compositional and nutritional targets.

Emma Hanby +44(0)1386 842262 emma.hanby@campdenbri.co.uk

Improving the nutritional profile of baked gluten and wheat free products by reducing fat, sugar and salt and improving fibre content

Campden BRI project 140160 (Sep 2016 – Aug 2018)

Funded by Innovate UK

The gluten-free and wheat-free market is growing. Its consumers are not only those who need to avoid wheat for medical reasons, but also those who believe that the products are generally more healthy. The removal of wheat and gluten from bakery products gives rise to a number of technological challenges, resulting in quality issues such as taste, eating quality and shelf life. In addition gluten-free and wheat-free products often have a poorer nutritional profile, being higher in fat, sugar and salt than wheat-containing breads. Whilst a number of technologies have been developed in wheaten bakery to support fat, sugar and salt reduction and increase fibre, there has been less focus on the development or application of such technologies to wheat-free and gluten-free bakery products. The aim of this project is to reformulate gluten-free and wheat-free bakery products to improve the overall nutritional profile by reducing fat, sugar and salt and improving fibre whilst maintaining or improving the quality aspects.

Michael Adams +44(0)1386 842284 michael.adams@campdenbri.co.uk

Innovative salt reduction and fibre enhancement of artisanal sourdough bread products (Optimise)

Campden BRI project 140113 (Sep 2016 – Aug 2018)
Funded by Innovate UK

The project seeks to drive the development and commercialisation of an innovative range of scalable artisanal sourdough products with significantly reduced salt and increased fibre. There is growing scientific evidence that suggests sourdough could be used to overcome the challenges of providing more nutritious bread (lower salt/sugar, increased fibre) to a wider audience whilst improving product quality and palatability. The project will establish an innovative, integrated UK supply chain of sustainably sourced ingredients, including seaweed and organic cereal grains, and tailor them for sourdough production in order to overcome the scalability challenges that have previously inhibited efforts to bring genuine organic sourdough products to the mass market.

Michael Adams +44(0)1386 842284 michael.adams@campdenbri.co.uk

Designing food and drinks for personalisation of diets for different life stages

Campden BRI project 138061 (Jan 2016 – Dec 2018)
Member funded

Globally the over 65s are the fastest growing segment of the population. In 2010, approximately 10 million people were over 65 in the UK; this figure is projected to reach 15 million by 2030 and 19 million by 2050. The population of over 85s was around 1.4 million in 2012; this figure is expected to increase to 3.6 million in 2037. The ageing process is accompanied by a decrease in sensory perceptions such as smell, taste, vision, and hearing, and body movement, and an increasing requirement for food and drink products that meet their changing needs. These demographic changes will result in significant challenges for manufacturers and packaging designers in terms of both nutritional requirements and inclusivity of packaged products, while at the same time creating opportunities for growth in new markets. This project will help address these challenges.

Sarah Chapman +44(0)1386 842212 sarah.chapman@campdenbri.co.uk

Improving the nutritional status of crops for the agri-food chain

Campden BRI project 138060 (Jan 2016 – Dec 2018)

Member funded

Fruit, vegetable and cereal crops are important sources of nutritional dietary components. Vitamins and minerals obtained from a balanced diet containing fruits and vegetables are important to maintain human health and optimise resistance to disease and infection. However, there is evidence that the intake of fruits and vegetables has fallen, leading to concerns over consumer health. Evidence also suggests that although crop yields may have increased, the nutritional quality and content of fruits and vegetables has declined over the past decades. This project will investigate the potential for enhancing the vitamin, mineral and phytochemical content of commonly consumed food crops using agronomic approaches and/or targeted crop nutrient supplementation, to optimise raw material quality for the agri-food chain.

Nick Saunders +44(0)1386 842162 nick.saunders@campdenbri.co.uk

Using crop genetics to understand the importance of dietary resistant starches for maintaining healthy glucose homeostasis

Campden BRI project 134915 (Sep 2014 – Aug 2018)

BBSRC DRINC Initiative at Imperial College, London

Pancreatic beta cell (BC) function is critically important to prevent development of insulin resistance and diabetes. BC function declines with age, chronically high levels of plasma glucose and raised free fatty acids (FFA). Data suggests an increase in GLP-1, lowering blood glucose and lowering FFA all protect BC function. Naturally occurring mutations of peas (*Pisum sativum*) result in high amounts of intrinsically resistant starch (RS). RS reaches the colon, where it is fermented to short chain fatty acids (SCFAs) which are linked to increased GLP-1 release from the colon, lower blood glucose, lower plasma FFA concentration, and direct action of the SCFA on the BC. All four can have positive effects on BC function. Our hypothesis is that intake of intrinsic RS from peas will be BC protective. If this proves true then consumption of seeds and cereals with intrinsic RS will offer public health solutions to slowing BC decline and maintaining glucose homeostasis with age. This will enable food manufacturers to formulate products which can help protect BC function.

Simon Penson +44(0)1386 842280 simon.penson@campdenbri.co.uk

Starch structure and cell wall digestion

Campden BRI project 132138 (Jan 2014 – Jan 2019)
BBSRC Studentship at King's College, London

This project will elucidate the fundamental mechanisms by which the benefits of from the consumption of cereal-derived beta-glucan are delivered. In particular, it will focus on the impact of beta-glucan on moderating post-prandial glycaemia and insulinaemia. The working hypothesis is that the mechanism is driven by the reduced rate of absorption resulting from a combination of slowed transit through the gastrointestinal tract (mediated by increased bolus viscosity) and the reduced rate of starch digestion (mediated by inhibition of alpha-amylase activity).

Simon Penson +44(0)1386 842280 simon.penson@campdenbri.co.uk

Sustainability, resilience and food security

Mitigating food fraud – best use of analytical screening tools

Campden BRI project 144035 (Jan 2018 – Dec 2019)
Member funded

There is a requirement for companies to comply with BRC Global Food Safety Standard 7 (Chapter 5.4) by minimising the risk of purchasing fraudulent or adulterated food raw materials and to ensure that all product descriptions and claims are legal, accurate and verified. In some situations testing of high risk raw materials and ingredients by using suitable tests will be needed. This project will use analytical screening approaches to show best practice for preparation and use of authenticity calibration.

Helen Brown + 44(0)1386 842016 helen.brown@campdenbri.co.uk

Using spent brewery grain to create a high fibre food ingredient

Campden BRI project 141268
Funded by Innovate UK

A collaboration between Mondelez International, Molson Coors, Campden BRI, Naturis and Atritor will develop and evaluate applications for a high fibre value-added ingredient generated from spent brewery grain. This project will call on the combined knowledge of these companies, whose expertise spans the full food chain from raw material generation and ingredient manufacture, through engineering, analytical and consumer science testing, product development and application to commercialisation of the new ingredient.

Joe McGurk+44(0)13868 42241 joe.mcgurk@campdenbri.co.uk

SEAFOODTOMORROW: Nutritious, safe and sustainable seafood for consumers of tomorrow

Campden BRI Hungary project (Nov 2017 – Oct 2020)
H2020-BG-2016-2017

This project aims to validate and optimise commercial solutions for improving the socioeconomic and environmental sustainability of the seafood production and processing industry, while contributing to product quality and safety. Activities will focus

on the sustainable production and processing of nutritious and safe seafood products through the demonstration and first application in the market of eco-innovative, sustainable solutions of marine and aquaculture-derived food products and nutrients. The project will take into account impacts across different regions and population segments, as well as the specificities of different types of seafood. Activities will include among others: utilisation of agro and seafood by-products to develop sustainable feeds for aquaculture enabling the production of tailor made products fortified with specific essential nutrients for consumers, assess the feasibility of salt replacers in seafood, validate digestible, attractive, functional and nutritionally adapted seafood for senior people and youths, validate strategies to prevent/remove contaminants from seafood, and optimise sensors and biosensors for the assessment of safety, among others. The consortium expects strengthening the wider utilisation of eco-innovative solutions, as a result of greater user acceptance, higher visibility of these innovative solutions and creation of scalable markets, and increasing the availability of healthier seafood to improve consumers' diet and health. The consortium is built on interdisciplinary research teams of 19 RTDs involved, renowned by its top-quality applied technological development and with strong and cohesive links gathered in previous funded activities (e.g. FP7 ECsafeSEAFOOD), thus anticipating successful outcomes. In addition, 4 IAGs and 13 SMEs with diverse and complementary interests in the solutions under validation and optimization will also integrate the consortium.

Adrienn Hegyi +36 1 433 14 70 a.hegyi@campdenkht.com

No Agro-Waste: Innovative approaches to turn agricultural waste into ecological and economic assets

Campden BRI Hungary project (Jan 2016 – Sept 2020)

Horizon 2020 – WASTE-7-2015: Ensuring sustainable use of agricultural waste, co-products and by-products (Project reference number: 688338)

Agro-waste represents a huge biomass resource that can be converted into sustainable bio-products. Driven by a “zero-waste” society requirement, NoAW aims to develop a circular economy approach applicable to agricultural waste on a territorial and seasonal basis. NoAW will establish new innovative eco-design and assessment tools for circular agro-waste management. Agro-waste resource use efficiency will be improved by upgrading the most widespread technology, anaerobic digestion, and by eco-design of innovative bio-processes and products (biomaterials, bio-molecules, bio-fertilizers and bio-energy). NoAW will involve all in the agriculture chain in order to ensure and accelerate the development of new business concepts.

András Sebők +36 1 433 14 70 a.sebok@campdenkht.com

Radio frequency assisted proving and baking (RF-ProBake)

Campden BRI project 136210 (Oct 2015 – Mar 2018)

Funded by Innovate UK

Radio Frequency (RF) is currently used by a small number of companies to help remove water from products post-baking. The principal objective of RF-ProBake is to introduce innovation by demonstrating the application of RF during both proving and baking stages of production as a way of increasing baking efficiency and reducing product waste. Baking consumes 35-40% of a plant bakery's energy requirements, with proving consuming another 5% of the energy costs; therefore, the potential savings could be large. Bread products will be the focus of this project due to the large reductions in energy and waste that are achievable; however, laminated pastries will also be investigated. RF-ProBake will lead to process and product innovation, adding value to existing processes while creating new products through the different energy delivery mechanisms.

Tiia Morsky +44(0)1386 842089 tiia.morsky@campdenbri.co.uk

Identification and monitoring activity on emerging issues in alcohol safety and legislation

Campden BRI project 132109

Member funded

Early warning of emerging issues and legislative changes is essential to reduce the impact of food safety and compliance issues in alcoholic beverages. This project involves horizon scanning using various sources on information including both technical and government information, and is international in scope. The work is collated into a monthly bulletin which is circulated electronically to members.

Jonathan Coleman +44(0)1737 824223 jonathan.coleman@campdenbri.co.uk

Skills and knowledge

Sampling for hazards: a practical guide

Campden BRI project 144036 (Jan 2018 – Dec 2018)
Member funded

There is little understandable practical guidance to answer questions on how many samples from a batch are adequate to show the risk level is acceptable or to show risk control methods are working. This project will describe and discuss sampling for different hazards associated with the food industry – such as microorganisms, chemicals, allergens, and so on. It will give guidance by use of case studies to describe suggested 'best practice' in different situations.

Phil Voysey + 44(0)1386 842069 phil.voysey@campdenbri.co.uk

A reference source: the microbiological effects of food processes

Campden BRI project 140914 (Jan 2017 – Dec 2018)
Member funded

Whilst there is a considerable volume of data available, there is no single, definitive, fully-referenced source of information on the effects of processes on problem microbes (e.g. D values, z values, organism survival, deviations of death kinetics, protective effects of specific ingredients and foods) – despite its potential usefulness to industry. This project will compile and publish a definitive reference on and guide to antimicrobial processes on different microbial groups. The range of food and drink types and manufacturing processes used will consider the microbiological implications that occur according to changes from one moisture content to another, or temperature regime or heating system to another and the subsequent applicability of the data. Such evaluations will include exceptional examples of when organisms are just injured and not destroyed and explain how these foods must have additional control measures to preserve the product throughout its shelf life.

Joy Gaze +44(0)1386 842064 joy.gaze@campdenbri.co.uk

SKIN - Short supply chain knowledge and innovation network

Campden BRI Hungary project (Dec 2016 – Dec 2019)

EU funded

SKIN is an initiative of 20 partners in 14 countries in the area of Short Food Supply Chains (SFSCs). The goals of the project are to systematise and bring knowledge to practitioners, promote collaboration within a demand-driven innovation logic and provide inputs to policymaking through links to the EIP-AGRI. One of main aims is to build and animate a community of about 500 stakeholders, around the identification of good practices in short supply chains across Europe. Partners will scout, analyse and classify a significant number of cases in different countries. Best practices will be systematised, processed into highly usable formats (including video and page-flows) and made accessible to stakeholders via the web (following the EIP AGRI formats) and through the set-up of regional nodes. The work on good practices will also allow identification of key issues (hindrances or opportunities) around SFSCs. Such issues will be the main themes of 6 innovation challenges workshops, the purpose of which is to stimulate stakeholders to propose new ideas for innovation based research or innovation uptake.

András Sebők +36 1 433 14 70 a.sebok@campdenkht.com

I-CON - Improving COmpetences and skills through food sector inNOvations

Interreg Central Europe Programme project CE393 (June 2016 – May 2019)

Funded by Interreg CENTRAL EUROPE

Slovenia, Hungary, Poland and Slovakia are facing declining employment opportunities in traditional industries as a result of structural change. This emphasises the need to take steps to stimulate economic activity with employment generating potential in regions that are facing difficulties in maintaining a critical mass of facilities to support economic development. Analysis shows that the food sector is potentially one of the most important fields in which to leverage improvements in the socio-economic situation in remote areas. Within this framework, those Central Europe Countries, together with Austria, Italy and Germany, will design and implement a sustainable transnational action plan to generate competitive advantages for SMEs and proactive hints for intermediaries and institutional representative levels. Ten competent partners, bringing knowledge competences and reliable and strong relationships with their local environments, will collaborate to improve entrepreneurial competences and skills in remote areas through food innovation potentials. Outputs of I-CON www.interreg-central.eu/Content.Node/I-CON.html will be a joint transnational food mentor scheme and a food crowd design platform usability.

András Sebők +36 1 433 14 70 a.sebok@campdenkht.com

FOODLAB: Sharing of knowledge between the academic and business worlds

Campden BRI Hungary project (Jan 2015 – March 2018)
Co-funded by the EU Erasmus+ Programme

According to FoodDrinkEurope, the food and drink sector in the EU is usually a key job provider and a relatively stable employer compared to other manufacturing sectors. However, the sector is usually described as less innovative. Companies, particularly SMEs, require employees who are able to manage innovative projects or drive innovation transfer. Students (as future employees) find it difficult to comprehend market reality and industrial constraints, show a lack of motivation toward entrepreneurship and focus their career choices on big companies. One of the aims of FOODLAB project (<https://foodlab-eu.com/>) is to improve transnational cooperation between education, training providers and other stakeholders by involving European universities, technical centres and SMEs in the development of the European Transfer Laboratory (EFTL). The shared web-platform will include training courses, e- tools and best practice guides.

András Sebők +36 1 433 14 70 a.sebok@campdenkht.com

Food Law Alert

Campden BRI project 138229
Member funded

Food Law Alert is a free fortnightly Campden BRI member service providing prompt and succinct news of developments in UK, EU and International food law, including details of new and proposed legislation and Codex and other expert committee meetings. Links are given to relevant websites from where further information is available.

Alison Sharper +44(0)1386 842282 alison.sharper@campdenbri.co.uk

Food safety and regulatory issues: contaminants applicable to brewing industry

Campden BRI project 132110

Member funded

Rapid access to information on food safety and regulatory issues is an essential part of controlling risk. In this project, information relating to maximum level for certain contaminants gathered from a variety of international regulatory sources is collated into searchable databases. In addition, briefing notes on key topics are generated and are made accessible to brewing members.

Klaudyna Terlicka +44(0)1737 824265 klaudyna.terlicka@campdenbri.co.uk

NutriSEA-Network of Universities and Enterprises for Food Training in Southeast Asia

Campden BRI Hungary project (Oct 2015 – Oct 2018)

Co-funded by the EU Erasmus+ Programme

The NutriSEA project is oriented towards the food sector, which represents a large share of the agriculture in the concerned Asian partner countries. It focuses on food-related curriculum development, the cooperation with enterprises via Technology Transfer Offices and strengthening internationalisation at partner universities in Cambodia, Vietnam and Myanmar. The long-term goal is to set up a regional food network with stakeholders from academia, business and authorities.

András Sebők +36 1 433 14 70 a.sebok@campdenkht.com

Projects completed in 2017

Review of novel natural preservative systems for use in drinks, sauces and other high a_w foods

Campden BRI project 140915 (Jan 2017 – Dec 2017)

Member funded

Grzegorz Rachon +44(0)1737 824268 grzegorz.rachon@campdenbri.co.uk

Foreign bodies in food and feed raw materials – hazards and controls

Campden BRI project 138062 (Jan 2016 – Dec 2017)

Member funded

Andrew Collins +44(0)1386 842105 andrew.collins@campdenbri.co.uk

A practical approach providing systems to evaluate threats and risks to assure the safe management of the supply chain

Campden BRI project 140911 (Jan 2017 – Dec 2017)

Member funded

Andrew Collins +44(0)1386 842105 andrew.collins@campdenbri.co.uk

PATHWAY-27: Pivotal assessment of the effects of bioactives on health and wellbeing - from human genome to food industry

Campden BRI Hungary Project (Jan 2013 – Dec 2017)

Funded under EU Food, Agriculture and Fisheries, and Biotechnology theme (KBBE)

András Sebők +36 1 433 14 70 a.sebok@campdenkht.com

Next generation techniques for microbiological and chemical food safety

Campden BRI project 134932 (Jan 2015 – Dec 2017)

Member funded

Suzanne Jordan +44(0)1386 842013 suzanne.jordan@campdenbri.co.uk

Control of viruses in food production

Campden BRI project 138918 (Jan 2015 – Dec 2017)

Member funded

Annette Sansom +44(0)1386 842263 annette.sansom@campdenbri.co.uk

An ingredient functionality approach to shelf-life extension of foods

Campden BRI project 134925 (Jan 2015 – Dec 2017)

Member funded

Sarab Sahi +44(0)1386 842140 sarab.sahi@campdenbri.co.uk

Quality validation for heat processed foods: improving product quality, reducing process energy and cost

Campden BRI project 134926 (Jan 2015 – Dec 2017)

Member funded

Martin George +44(0)1386 842037 martin.george@campdenbri.co.uk

An evaluation of traditional and novel sensory and consumer methods suitable for product characterisation

Campden BRI project 134927 (Jan 2015 – Dec 2017)

Member funded

Marleen Chambault +44(0)1386 842256 marleen.chambault@campdenbri.co.uk

Predicting the results of hop blending on final beer flavour/aroma using analytical and sensory methods

Campden BRI Project 135194 (Jan 2015 – Dec 2017)

Member funded

Javier Gomez-Lopez +44(0)1737 824276 javier.gomez-lopez@campdenbri.co.uk

Exploring new sensory methods of assessing beers, ciders and other alcoholic beverages

Campden BRI Project 135195 (Jan 2015 – Dec 2017)

Member funded

Javier Gomez-Lopez +44(0)1737 824276 javier.gomez-lopez@campdenbri.co.uk

Bakery products for non-coeliac gluten-sensitive consumers

Campden BRI project 132496 (Apr 2014 – Mar 2017)

Funded by Innovate UK

Simon Penson +44(0)1386 842280 simon.penson@campdenbri.co.uk

Using crop genetics to understand the importance of dietary resistant starches for maintaining healthy glucose homeostasis

Campden BRI project 134915 (Sep 2014 – Aug 2017)

BBSRC DRINC Initiative at Imperial College, London

Simon Penson +44(0)1386 842280 simon.penson@campdenbri.co.uk

Manipulation of food structure and protein content to produce satiating, energy reduced foods and beverages

Campden BRI project 134928 (Jan 2015 – Dec 2017)

Member funded

Charlotte Holmes + 44(0)1386 842257 charlotte.holmes@campdenbri.co.uk

Impact of food processing on the blood cholesterol-lowering effect of cereal beta-glucan

Campden BRI project 135263 (Jan 2015 – Dec 2017)

BBSRC DRINC Initiative at King's College, London

Simon Penson +44(0)1386 842280 simon.penson@campdenbri.co.uk

Packaging design - a strategic approach to enhance consumers' sensory perceptions and overall enjoyment of healthy food and drinks

Campden BRI project 134929 (Jan 2015 – Dec 2017)

Member funded

Sarah Thomas +44(0)1386 842254 sarah.thomas@campdenbri.co.uk

Funding body abbreviations

BBSRC	Biotechnology and Biological Sciences Research Council
CASE	Collaborative Awards in Science and Engineering
DRINC	Diet and Health Research Industry Club
EU	European Union
EPSRC	Engineering and Physical Sciences Research Council
FSA	Food Standards Agency
Innovate UK	Non-departmental public body, sponsored by the Department for Business, Innovation and Skills