



DRINC • DIET AND HEALTH RESEARCH INDUSTRY CLUB

## EXECUTIVE SUMMARY

### Diet and Health Research Industry Club (DRINC)

The Biotechnology and Biological Sciences Research Council (BBSRC), in partnership with the Medical Research Council (MRC) and the Engineering and Physical Sciences Research Council (EPSRC), established DRINC in 2007 to encourage increased engagement in the UK research base with the challenges surrounding diet and health.

In partnership with a consortium of leading food and drink companies, over £19M has been awarded to enable high quality research within UK universities and research institutes. The research has helped the food industry to develop products that deliver enhanced health benefits for consumers.

In 2011, an independent evaluation found that DRINC has generated novel underpinning knowledge and improved skills in a research community that provides valuable pre-competitive outputs for the UK food and drink industry. The evaluation recommended continuation of the Club to maintain the UK's strength in diet and health research. The second phase of DRINC launched in 2012 with support from 14 company members.

#### Introduction

BBSRC has identified developing a greater awareness of the roles of nutrition and physical activity, and the mechanisms by which they affect development and health, as a goal within the key strategic priority of Bioscience for Health. The importance of the link between diet and health is recognised by the public however the complex interactions between dietary components and the consequences for health are not well understood.

The food industry is a significant contributor to the UK economy; it is the single largest manufacturing sector, employs 3.7 million people, and accounts for around 7% of GDP. The industry contributes to the UK meeting the challenges of providing a nutritious, safe, accessible and sustainable supply of food to a growing and ageing population in a world with increasingly scarce resources.

The Diet and Health Research Industry Club (DRINC) is a BBSRC led investment programme which enables the UK research base to contribute to the substantial innovation opportunities connected to the challenge of delivering of a healthier diet to the UK population. Designing foods that support human health is a driver for businesses across the supply-chain which have benefitted from the pre-competitive research supported by the Club. The research projects are multidisciplinary in nature and connect researchers in the nutritional and biological sciences, with experts in food engineering, and the physical and social sciences.

#### DRINC Research Challenges

Three research challenges were identified for the second phase of DRINC through discussions with the industrial membership. The challenges fit into the overarching theme of improving our understanding of the relationship between diet and health:

- Designing foods to maintain and improve health
- Understanding the relationship between food processing and nutrition
- Understanding food choice and eating behaviour to improve health through diet

DRINC is a cross-council programme and so the challenges reflect BBSRC's research priorities but also extend to areas of relevance for EPSRC and MRC, which have also provided funding to the research projects. The research challenges build upon the two research themes of the first phase: "improving our understanding of healthier diets" and: "exploring the benefits of bioactives in foods".

DRINC is managed by BBSRC in conjunction with an external coordinator and a steering group made up of industry and academic representatives.

### **Benefits of Interacting with BBSRC and the Research Community**

BBSRC has a strong record in managing collaborative research programmes, including the Research Innovation Club mechanism. Companies report a range of significant benefits from their involvement with BBSRC:

- Capacity to influence research in important strategic areas
- Knowledge on the progress of relevant research projects and early access to results
- Opportunity to work with leading researchers and to build strong relationships with them
- Opportunity to identify the best potential industry recruits
- Guidance on other Research Council activities and funding opportunities
- Promotion of companies through relevant activities, objectives and outputs

### **Delivering Industrial Impact**

DRINC has delivered new capabilities for the food and drink industry and has addressed significant research challenges associated with diet and health. The projects have already generated useful outputs which are being used by the member companies, for example:

- Established that vitamin D3 supplements have greater health benefits than vitamin D2 in order to inform future biofortification of food products.<sup>1</sup>
- Enabled UK research base participation in EU FP7 consortia, such as DAPHNE, SATIN, BIOCLAIMS<sup>2</sup>
- Demonstrated that dietary supplements in dairy cows can deliver human health benefits by lowering the saturated fat content of milk.<sup>3</sup>
- New patent applications including, for example, the use of propionate inulin ester to reduce appetite and weight gain in humans.<sup>4</sup>
- Development of a new methodology – the consumer expectation toolbox – which has been used by industry to explore the expected satiety of products.<sup>5</sup>
- Generated new insights into differences in how probiotics modulate the immune system in young and old people which can inform the design of functional foods across the lifecycle.
- Demonstrated that including alginates in baked goods can support weight management.<sup>6</sup>

For further information please visit the DRINC web pages at: [www.bbsrc.ac.uk/drinc](http://www.bbsrc.ac.uk/drinc)

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<sup>1</sup> [www.bbsrc.ac.uk/news/health/2012/120531-pr-health-benefits-of-vitamin-d/](http://www.bbsrc.ac.uk/news/health/2012/120531-pr-health-benefits-of-vitamin-d/)

<sup>2</sup> [www.bbsrc.ac.uk/news/health/2014/140915-pr-superfoods-help-protein-bodies-healthy/](http://www.bbsrc.ac.uk/news/health/2014/140915-pr-superfoods-help-protein-bodies-healthy/)

<sup>3</sup> [www.bbsrc.ac.uk/news/health/2015/150622-f-new-adventures-in-high-street-milk/](http://www.bbsrc.ac.uk/news/health/2015/150622-f-new-adventures-in-high-street-milk/)

<sup>4</sup> [www.bbsrc.ac.uk/news/food-security/2014/141216-pr-ingredient-that-will-make-you-feel-fuller/](http://www.bbsrc.ac.uk/news/food-security/2014/141216-pr-ingredient-that-will-make-you-feel-fuller/)

<sup>5</sup> [www.bbsrc.ac.uk/news/health/2013/130204-f-would-you-like-to-supersize-that/](http://www.bbsrc.ac.uk/news/health/2013/130204-f-would-you-like-to-supersize-that/)

<sup>6</sup> [www.bbsrc.ac.uk/news/health/2013/130228-f-health-by-stealth/](http://www.bbsrc.ac.uk/news/health/2013/130228-f-health-by-stealth/)

## ANNEX 1

### DRINC PHASE 1 RESEARCH PORTFOLIO

25 research projects were funded through three rounds in 2008, 2009, and 2010. Research was undertaken from 2008 to 2014.

Detailed project information can be found online by using the BBSRC reference numbers to search:

- RCUK Gateway to Research: <http://gtr.rcuk.ac.uk/>
- BBSRC Portfolio Analyser: [www.bbsrc.ac.uk/research/grants-search/quicksearch/](http://www.bbsrc.ac.uk/research/grants-search/quicksearch/)

#### Designing healthier foods

Reference number	Principal Investigator	Research Organisation	Project Title
BB/H004866/1	Dr Peter Ellis	King's College London	Role of Plant Cell Walls in Regulating Starch and Lipid Bioaccessibility from Plant Foods: In Silico, In Vitro and In Vivo Studies
BB/I006079/1	Prof Peter Fryer	University of Birmingham	Mining diversity in cereal (wheat) fibre to improve the nutritional quality of bread
BB/G005478/1	Prof Ian Norton	University of Birmingham	Copy of Self structuring foods with slow burn for control of satiety
BB/G005583/1	Dr Roger Parker	Institute of Food Research	Enhancing delivery of minerals using multifunctional carriers
BB/G00563X/1	Prof Jeffery Pearson	Newcastle University	Bioactive Alginates and Obesity

#### Enhancing cardiovascular Health

Reference number	Principal Investigator	Research Organisation	Project Title
BB/I006087/1	Prof Ian Givens	University of Reading	Reducing saturated fatty acids in the food chain through alteration of milk fat composition
BB/H004963/1	Dr Colin Kay	University of East Anglia	Effects of Fruit Juice Processing and Human Metabolism on the Functionality of Anthocyanins for Cardiovascular Health
BB/I006028/1	Dr Colin Kay	University of East Anglia	The collective bioactivity of dietary flavonoids: importance of specific structural characteristics for cardiovascular benefits
BB/G005702/1	Dr Jeremy Spencer	University of Reading	The Impact of Cocoa Processing on Flavanol Content, Absorption and Health Effects
BB/G005699/1	Prof Paul Thornalley	University of Warwick	Dietary activators of antioxidant response element-linked gene expression for good vascular health
BB/I005862/1	Prof Caroline Wheeler-Jones	Royal Veterinary College	Unravelling the mechanisms of vascular protection by omega-3 PUFAs to optimise and support their use as bioactives by the food industry

## ANNEX 1

### Improving our understanding of gut health and function

Reference number	Principal Investigator	Research Organisation	Project Title
BB/H004971/1	Prof Gary Frost	Imperial College London	Increased Propionate Production In The Colon Is Associated With Reduced Appetite, Body Weight And Improved Insulin Sensitivity
BB/H004734/1	Prof Glenn Gibson	University of Reading	Influence of prebiotics on human gut microbiota, LPS and markers of metabolic syndrome.
BB/H005013/1	Prof John Mathers	Newcastle University	Impact of non-digestible carbohydrates on biomarkers of GI health: a human intervention study
BB/G005591/1	Prof John McLaughlin	University of Manchester	Defining the gut-to-brain signalling mechanisms underlying responses to nutrients
BB/H00470X/1	Prof Parveen Yaqoob	University of Reading	Immunomodulatory effects of pre- and probiotics
BB/I005609/1	Prof Fiona Powrie	University of Oxford	Dendritic cell subsets in the maintenance of gut health and response to bioactives

### Nutrition across the life-course

Reference number	Principal Investigator	Research Organisation	Project Title
BB/I006060/1	Prof Ian Clark	University of East Anglia	Can bioactive compounds from the diet prevent the onset or slow the progression of osteoarthritis?
BB/I005994/1	Prof Malcolm Jackson	University of Liverpool	Dietary polyphenols as modulators of redox signalling pathways to reduce chronic inflammation in the elderly
BB/I006192/1	Prof Susan Lanham-New	University of Surrey	Ergocalciferol (D2) vs. Cholecalciferol (D3) Food Fortification: Comparative Efficiency in Raising 25OHD Status & Mechanisms of Action (D2-D3 Study)
BB/G005575/1	Prof Lesley Rhodes	University of Manchester	The effect of dietary bioactive compounds on skin health in humans in vivo

### Supporting healthier diets

Reference number	Principal Investigator	Research Organisation	Project Title
BB/G005524/1	Prof John Blundell	University of Leeds	Drivers of eating behaviour during chronic overconsumption: Role of food hedonics (liking & wanting) and peptide biomarkers on satiation and satiety.
BB/G005443/1	Dr Jeffrey Brunstrom	University of Bristol	Understanding decisions about portion size: The key to acceptable foods that reduce energy intake?
BB/I006168/1	Dr Peter Wilde	Institute of Food Research	Enhancing the consumer perception of reduced fat foods through interfacial design and rheological behaviour
BB/H004645/1	Prof Martin Yeomans	University of Sussex	Maximising satiety through manipulating expectations, sensory quality and nutrient content.

## ANNEX 2

### DRINC PHASE 2 RESEARCH PORTFOLIO

The second phase of DRINC has allocated funding to 18 research projects through three rounds in 2013, 2014 and 2015. Research activity in this phase will continue until 2020.

Detailed project information can be found online by using the BBSRC reference numbers to search:

- RCUK Gateway to Research: <http://gtr.rcuk.ac.uk/>
- BBSRC Portfolio Analyser: [www.bbsrc.ac.uk/research/grants-search/quicksearch/](http://www.bbsrc.ac.uk/research/grants-search/quicksearch/)

#### Designing foods to maintain and improve health

Reference number	Principal Investigator	Research Organisation	Project Title
BB/L025485/1	Prof Ian Clark	University of East Anglia	Synergistic combinations of diet-derived bioactives to maintain joint health and prevent osteoarthritis
BB/M027724/1	Prof Christine Edwards	University of Glasgow	Manipulating the activity of the gut microbiota with fermentable carbohydrates to maximise the bioavailability of bioactive phenolic acids for health
BB/L025582/1	Prof Gary Frost	Imperial College London	Using crop genetics to understand the importance of dietary resistant starches for maintaining healthy glucose homeostasis
BB/M027252/1	Dr Albert Koulman	MRC Centre Cambridge	The validation of biomarkers of metabolic efficacy in infant nutrition
BB/L025515/1	Prof Peter Shewry	Rothamsted Research	Speciation and bioavailability of iron in plant foods
BB/M027406/1	Prof Gary Williamson	University of Leeds	Improved glycaemic response and attenuated post-prandial sugar-induced endothelial dysfunction by polyphenol-rich foods
BB/N020987/1	Dr Sarah Berry	King's College London	The health impact of industrial interesterification of dietary fats
BB/N021800/1	Professor Simon Andrews	University of Reading	The relationship between dietary iron and the gut microbiota. Can dietary iron regime be exploited to improve health?

#### Understanding the relationship between food processing and nutrition

Reference number	Principal Investigator	Research Organisation	Project Title
BB/L025272/1	Dr Peter Ellis	King's College London	Impact of food processing on the blood cholesterol-lowering effect of cereal beta-glucan
BB/M027449/1	Dr Stephen Euston	Heriot-Watt University	Edible Oleogels for Reduction of Saturated Fat
BB/M027139/1	Dr Bettina Wolf	University of Nottingham	Programmed emulsions for reduced levels of salt or sugar in liquid and semi-liquid foods
BB/N021002/1	Professor Paul Sharp	King's College London	Increasing Micronutrient Bioavailability from Wheat
BB/N021126/1	Dr Ian Fisk	University of Nottingham	Reducing sodium in the UK diet through food processing and ingredient design
BB/N021185/1	Dr Parveen Yaqoob	University of Reading	Effects of n-3 polyunsaturated fatty acids on the generation and functional activities of microparticles
BB/N021274/1	Margaret Denise Robertson	University of Surrey	Resistant Starch Production and Glucose Release from Pre-Prepared Chilled Food; the SPUD Project

## ANNEX 2

### Understanding food choice and eating behaviour to improve health through diet

Reference number	Principal Investigator	Research Organisation	Project Title
BB/M027384/1	Prof Marion Hetherington	University of Leeds	Downsizing: using environmental prompts to understand healthy portion control and appropriate food servings in children, adolescents and caregivers
BB/L02554X/1	Prof Peter Rogers	University of Bristol	Nudge150: Combining small changes to foods to achieve a sustained decrease in energy intake
BB/L02540X/1	Prof Jeremy Spencer	University of Reading	Mechanistic assessment of the acute and chronic cognitive effects of flavanol/anthocyanin intervention in humans