

Institution: University of East Anglia

Unit of Assessment: 6 - Agriculture, Veterinary and Food Science

a. Context

Nutrition research at UEA is focused on understanding the effects of food and its constituents on human health, and on the prevention of chronic diseases associated with ageing. Being located on the Norwich Research Park provides a unique opportunity to conduct research on all aspects of nutrition, from plant metabolism through to public health. Our research is primarily at the translational end of this spectrum, conducting studies in healthy or 'at-risk' population subgroups. In this respect **health policy and public health are the primary impacts** resulting from our research programmes. Such impacts are achieved through close interactions with a range of users including the food industry, UK government, international committees and policy makers, national and international media, health care professionals, and the general public.

b. Approach to impact

Our approach, designed to ensure maximum impact from our research, is firstly to investigate the influence of whole foods, or physiologically relevant intakes of individual dietary components, on the risks of a range of common age-related chronic conditions (including cardiovascular disease, sarcopenia and type 2 diabetes); and secondly to interact with relevant stakeholders at all stages of the research process. This approach is exemplified in the following ways:

Interaction with national and international policy making organisations: We ensure engagement with policy makers through our invited membership of key UK, EU and US committees involved in the derivation of dietary recommendations, policy and health claims ensuring the provision of a sound scientific evidence base. Examples include:

- The EU Food Safety Authority, the risk assessment body for food safety. Fairweather-Tait and Cassidy are both members of advisory panels; Fairweather-Tait sits on the Nutrition Panel and the Working Groups on Health Claims and Population Reference Intakes (2009-2012), Cassidy was a core member of the panel examining risks:benefits of soy isoflavones to health, and acted as an expert advisor on submitted health claims on soy.
- WHO Nutrition Guidelines Expert Advisory Group. Hooper and Fairweather-Tait are members of the subgroup on Diet and Health.
- Harvest Plus (funded by Bill & Melinda Gates) facilitates policies for biofortification of food crops. Fairweather-Tait advises on micronutrient bioavailability for the prevention of deficiency diseases.
- International Life Sciences Institute (ILSI), 'a worldwide academic/industrial organisation whose mission is to provide science that improves public health and well-being'. Cassidy and Minihane serve as academic experts on ILSI EU and North America panels.

Collaborative research with national and EU-based policy makers: Our approach to collaborative research with National and EU academic/industrial partners supports and enables impact by providing a robust knowledge-base on which to refine policy and dietary recommendations. Examples include:

- EURRECA (European micronutrient Recommendations Aligned) was an EU FP6 Network of Excellence which integrated 35 member organisations and included scientists, representatives of nutrient requirement setting bodies, consumer organisations, small & medium-sized enterprises and wider stakeholders from across Europe. It developed methodologies to standardise micronutrient recommendations (Fairweather-Tait, Hooper). Our publications, predominantly published in the American Journal of Clinical Nutrition, are now being used extensively by expert groups and policy makers concerned with micronutrients, for example: systematic reviews of biomarkers of status; micronutrient bioavailability – for setting Dietary Reference Values; biomarkers of nutrition for policy-making in developing countries.
- NU-AGE is an EU FP7 funded 30 partner project from 16 EU countries which is focused on new dietary strategies addressing the specific needs of elderly populations for healthy ageing. We are one of 5 partners leading a large 1-year dietary intervention in the elderly. The impact of this research is that it will directly support EU strategies on nutrition recommendations and

health claims for the elderly, lead to the development of foods tailored for the elderly, and promote improved understanding of a healthy diet through the activities of the *European Food Information Council* (EUFIC).

- European Food Safety Authority (EFSA), (2011-2012, Fairweather-Tait, Hooper). Funded by EFSA, state-of-the-art systematic reviews were conducted on a number of micronutrients including magnesium, manganese and potassium to provide novel insights into dose response relationships, identify research gaps, and provide a solid framework to EFSA to inform EU-wide and member state expert bodies revising Dietary Reference Values.

Interaction with industrial organisations: A large component of the research which we conduct has significant industrial input from partners who either supply commercially available foods for intervention trials, develop foods with enhanced composition as part of a programme of work, or fully fund a particular research project. This approach of directly testing dietary constituents in our human clinical trials ensures our research provides direct impact for industrial and consumer benefits. Examples include:

- *Bristol Myers Squibb* funded projects which resulted in a patent filing with Cassidy as the named inventor: Composition and method of phytonutrients for metabolic programming effects (13/273,652 - filed Oct 14, 2011).
Warwick E, Cassidy A, Hanley B, Jouni ZE, Bao Y (2012). Effect of phytochemicals on phase II enzyme expression in infant human primary skin fibroblast cells. Br J Nutr. 108(12):2158-65.
- *Unilever* funded a clinical trial to investigate the role of dietary constituents in reducing skin ageing which underpins the constituents and evidence-base of the food supplement they launched as part of their 'Dove' brand (Dove Spa Strength Within supplements).
Curtis PJ, Kroon PA, Hollands WJ, Walls R, Jenkins G, Kay CD, Cassidy A (2009). Cardiovascular Disease Risk Biomarkers and Liver and Kidney Function Are Not Altered in Postmenopausal Women after Ingesting an Elderberry Extract Rich in Anthocyanins for 12 Weeks. J Nutr; 139(12):2266-71.
- *Unilever* directly funded 2 PhD studentships and a research project on green tea, genetics and cardiovascular health, and postprandial lipid handling.
- Stable isotope studies to measure the bioavailability of calcium from ice-cream (*Unilever*) and iron from an apple juice drink (*Coca-Cola*) have resulted in new product developments.
- Since 2008 we have been awarded 8 industrial BBSRC CASE studentships (including *GSK, Unilever, Kelloggs*).

Interaction with science communicators & non-specialist audiences: We convey our findings to non-specialist audiences in a balanced and understandable manner through on-going collaborations with the main UK and EU food and nutrition communication organisations. Examples include:

- Council membership of the British Nutrition Foundation, which is the largest UK based nutrition communication organisation, providing nutrition information to the media, industry, educators, health professionals and the general public.
- Working closely with EUFIC to facilitate the public health impact of our EU-funded projects (EURRECA and NU-AGE). Recent research collaborations with EUFIC are examining the reporting of nutrition and food safety issues in national newspapers across the EU.

As a part of this approach, an important pathway to achieving impact is through ensuring that our work is available to the wider public via the national and international press. Recent examples include our flavonoid research, with significant coverage in the international press of our long-term trial in postmenopausal women (Curtis *et al.* 2012), and press releases from the American Heart Association on two of our Harvard collaborations (Cassidy *et al.* 2012, 2013). In particular, our paper in 'Circulation' resulted in 390 stories in the international press, radio and TV, that were viewed by an estimated audience of 289 million people.

Support for Impact: The University was recently (May 2013) awarded BBSRC and NERC Impact Funds to further develop societal and economic impact from research that has been funded by these two councils, and to strengthen interactions with the business community. The UEA Enterprise Executive is awarding this funding competitively to develop impact from research projects identified as having significant impact potential. At UEA, impact generation is a criterion, alongside teaching and research, for promotion and sabbatical leave (to organisations such as

EFSA and WHO). UEA has a highly proactive communications team who work closely with us to enhance the potential impact of our research outputs and who co-ordinate extensive external media training and support for all our senior staff.

c. Strategy and plans

Our existing relationships with global policy makers and major food producers puts us in a strong position to develop more impact from our research. At the heart of our impact strategy for the next five years is maintaining the wide public health relevance of our research by focussing on key dietary components (with a specific focus on dietary fats and plant bioactives). We will determine their impact on health and ability to prevent prevalent age-related chronic conditions including cardiometabolic diseases and co-morbidities (cognitive decline, muscle dysfunction).

Our current research strategy incorporates both projected impact and pathways to impact into our project planning and milestones/deliverables. For example, through our BBSRC Programme grant, USDA, and industrial funding (e.g. *Abbott, GSK, PepsiCo*) we will further establish effective doses of individual bioactives for optimal health and provide novel insights into how they are absorbed and metabolised in humans. EU and ILSI USA expert groups have been established (Cassidy is a member) to begin to define and establish, for the first time, specific recommended intakes for different plant bioactive sub-classes. The ultimate goal of this work will be to develop dietary recommendations for specific plant bioactives (flavonoids) which will in turn lead to a much needed refinement with respect to types and quantities of fruits and vegetables, of the current generic '5-a day' public health message. The information required to provide targeted advice to specific 'at risk' sub-groups will also emerge from our planned randomised controlled trials. Another major predicted impact relates to food security and sustainability. Our research, in collaboration with global seed oil producers (*ADM*), will investigate GM oils, and enhanced biosynthesis in humans, as critical alternatives to depleting marine sources of beneficial omega-3 fatty acids. Our fatty acid research programme will also continue to establish dose-response relationships and inform recommended intakes in relation to cognitive and vascular health.

Our established and more recently secured (*MARS, Florida Citrus, Barry Callebaut*) collaborations with the food industry provide an important pathway to impact. They will ensure public health impact in a timely fashion through the development and testing of food products for optimal health. Our recent Technology Strategy Board award is one good example. Patent filing will also be a greater focus in our future pathway to impact strategy as our current molecular work and human studies (specifically in the area of anthocyanins) continue to identify novel plant bioactive metabolites with commercial potential.

As a Department, through our annual appraisals and workload models, we regularly assess and review our impact achievements and strategy and ensure we allocate considerable time to establishing, maintaining and fostering relationships with policy makers and industrial colleagues.

d. Relationship to case studies

Although nutrition research at UEA was established only in 2004, we have already achieved considerable impact from our research. Both impact case studies provide evidence of our **interaction with national and international policy making organisations**, illustrating the significant translational relevance of our work. Our extensive international network of collaborators, our involvement in a number of US and EU based government and industry committees, and our interactions with key players in the food industry have provided the basis for our two case studies. This is exemplified in our micronutrient case study '*Micronutrients and health: refining dietary requirements and addressing deficiencies to ensure future food security*', which shows how our research supported and enabled impact by adding to the evidence needed for the development of WHO, EU and national recommendations (including the first WHO guideline on intakes of potassium and sodium). Our systematic reviews have provided solid evidence to support public health policies and guidelines for dietary recommendations, including work conducted for EFSA, and to derive dietary reference values and Nordic nutrition recommendations and guidelines. Our second case study '*Risk assessment and health claims for soy and human health*' also demonstrates the success of our impact strategy, as our research has provided robust data to further inform the international policy debate on health claims for soy foods, and has contributed to risk assessment in the UK, EU and USA related to soy food and supplement consumption.