Institution: Newcastle University

Unit of Assessment: UoA 3

a. Context

In the Centre for Oral Health Research (COHR) and the Human Nutrition Research Centre (HNRC) we undertake applied research focussed on some of the dominant public health issues of our time: poor oral health (with an annual public cost of £2.5 billion), obesity and obesity-related disease (>£16 billion per year) and age-related chronic disease. Beneficiaries of our work include **patients**; the **NHS**; **commercial partners** (goods and services related to food, nutraceuticals, dental care and diagnostics); **government departments** and **organisations** such as the National Institute for Health and Clinical Excellence and the Food Standards Agency; **non-governmental organisations** such as the World Health Organisation (WHO) (e.g. guidelines, interventions, health care delivery); **tax payers**; the wider economy and the **public**. We can evidence i) established industrial and commercial partnerships; ii) authoritative clinical guidelines and iii) high level policy impacts. In addition, most COHR researchers are embedded within the shared academic and clinical facility of the NHS Dental Hospital, so patient and public impact is a daily reality for all researchers.

Laboratory Science: Molecular Nutrition and Oral Biosciences

Our laboratory-based research impacts in oral health and nutrition are derived predominantly through our work with **industrial partners.** In **Molecular Nutrition** there are also close working relationships between HNRC researchers and **industry**. This activity includes directly industry-funded projects, an example being epigenetics-related research carried out by ***Ford*** and funded by **Unilever.** We also generate impact through publically-funded research projects with industrial partners, for example ***Mathers***' research on diet-responsive biomarkers of bowel cancer risk which is BBSRC-funded through the Diet and Health Research Industry Club (DRINC) and includes **Danisco (DuPont)** as a partner, and MRC-funded research on bowel cancer prevention with **Bayer** and **National Starch** as partners. Our large EU-funded research programmes such as the FP7 *food4me* project (***Mathers***) include large companies (**Phillips** and **DSM**) as well as SMEs as partners. Our research also supports government policy making on dietary reference values particularly in respect of work funded by the Food Standards Agency (FSA) (***Hesketh, Mathers***).

In **Oral Biosciences** we develop technologies to detect and prevent oral diseases and to reduce their impact on patients. ***Preshaw*** has completed a collaborative project with **Phillips** to identify saliva biomarkers allowing gum disease to be detected before it causes damage and, with ***Taylor***, has now secured TSB/EPSRC funding to work with two biotechnology companies (**Orla Protein Technologies** and **OJBio Mobile Diagnostics**) to develop a device to support chair-side detection. Working with marine biologists, ***Jakubovics*** has discovered a nuclease enzyme capable of breaking up oral biofilms ("plaque busting") with huge potential benefits for patients. There are now confidentiality agreements in place with **Alcon**, **GSK**, **Norbrook**, **Novozymes** and **Procter & Gamble**. We have two CASE studentships in biomaterials with **GSK**, one on nanoscale erosion of dental hard tissues and the other on re-mineralising toothpastes.

Health Care and Public Health Research

In **Oral Health Care and Epidemiology** the main beneficiaries of our research are the **public** and **patients** through our contribution to the development of national policy and professional standards. ***Steele***'s work on health policy is described in one of our impact cases. Our published work in economics concentrates on ensuring optimum value for the **taxpayer** by identifying how public resources can be used effectively and has been used in the policy making process by OFT, the Independent Review of NHS Dentistry and the Department of Health. Steele has led the independent oversight of the current NHS contract reform programme (NHS-dental-contract-pilots-early-findings.pdf). ***Steele*** was the invited overseas expert on the Canadian Academy of Health Sciences policy report on inequalities ("Improving access to oral care for vulnerable adults in Canada, 2013") and recently advised the Health Services Executive in Ireland on resource use and services. ***Maguire***'s work on fluoride has informed the development of strategies for optimising milk fluoride concentration in areas of the UK where fluoridated school milk is provided to many thousands of children to prevent dental caries. ***Moynihan***'s work on sugars has informed the WHO population guidelines on nutrition. We expect to see a new evidence-based guideline on sugars based on her work in the near future. In terms of impact on clinical practice and professional standards, ***Meechan*** is recognised globally as a leading authority on local analgesia (LA) and his

published trials underpin the clinical teaching in his popular text books (e.g. '*Practical Dental Local Anesthesia'*) available in several languages and widely used in undergraduate dental schools, benefiting millions of dental patients worldwide through their influence of local analgesia practice. He has served as a consultant to the main LA manufacturers and won the overall prize in the prestigious UK Health Innovations Award (2011) for a redesigned cartridge. ***Meechan*** (LA cartridges) and ***Heasman*** (powered toothbrushes) have served within the REF period on the International Standards Organisation (ISO) as advisors. Two large scale HTA trials (FiCTIoN, jointly led by Dundee and Newcastle and IQuAD, Dundee-led but with Newcastle as the major partner) will answer important questions about dental care (should we fill deciduous teeth; does the routine scale and polish benefit health?) which can be expected to inform practice and directly benefit patients. Trials in sedation led from Newcastle have been incorporated into national sedation guidelines (see impact case "A second-line option for conscious sedation of children during dental procedures).

The major beneficiaries from **Public Health Nutrition Research** are the **public**. Recent work by ***Adamson*** with the "Hairy Bikers" resulted in a major TV series and book to help the public interpret science related to nutrition and take practical steps to combat obesity. Her work with government on front-of-pack nutritional labelling is described in detail in case study "Front of Pack "traffic lights" nutrition labelling adopted across the UK". Much of the work we do in this area, including work funded by Research Councils, has a very clear path to impact e.g. interventions to address childhood obesity and the development of better tools for dietary assessment which can be used in national surveys of food and health.

b. Approach to impact

Both oral health and nutrition research are public- and patient-focussed. The work we undertake is applied in its focus but, recognising that even applied research is often not adopted, we use three distinct approaches to maximise the scale of the impact of our research; (1) early engagement with industry to embed industrial translation, using University support mechanisms; (2) strategic consultancy and collaboration both with industry partners and government policy makers to ensure senior researchers are close to decision making, with reinvestment of resource earned back into early stage research; (3) consistent, simple and positive public health messaging through the media, as well as directly through schools and other routes.

Links with industry are the route to impact for much of the laboratory-based molecular research in both centres. Underpinning this is the University's Research and Enterprise Service which provides faculty-wide support for consultancy and commercial enterprises. It makes expertise available and is easy to access, as evidenced by the relationships described in the previous section. Awareness of the importance of impact is raised through seminars and discussions with invited speakers from industry and from the University's Research and Enterprise Service. At an individual project level, we engage with the Business Development Managers at an early stage to identify routes to exploitation and impact e.g. the LiveWell Programme. We also encourage staff to attend courses and workshops such as the "Commercialising Science" course. Through participation in the "Biotechnology YES (Young Entrepreneurs Scheme)" competition run by BBSRC, our PhD students in nutrition have gained experience of the steps involved in commercialisation of research-led ideas. Success in CASE studentships (see above) and commercial sponsorship for intercalating dental students mean that commercial links are established early for early career researchers. Embedding the ethos of early engagement in our early career researchers is an investment in future impact.

Advisory positions to government departments and large commercial oral health organisations have been held by ***Steele*** (DH, **Colgate**, **J&J**), ***Meechan*** (**Septodont**) and ***Adamson*** (DH). Consultancy through the University is encouraged and the resource earned is recycled allowing continued development and flexibility but with an incentive to the researcher by returning some resource to personal research accounts. The Centres' consultancy earnings are reinvested through small grants and administrative support for projects where impact can be identified. For example, the work of ***Jakubovics*** on a biofilm dispersing enzyme was supported by the COHR through its early stages, using money derived from third strand activity. This took development to a stage where it became of commercial interest. This balanced approach encourages commercial activities whilst supporting the wider research effort, particularly for early career researchers.

As public employees we see it as a responsibility to get consistent, positive and accurate health messages based on our research out to the wider public at every opportunity. During the assessment period we can evidence dozens of episodes of national and international media exposure (radio, television, newspapers, magazines and web) particularly involving *Adamson* (notably the "Hairy Bikers" work), ***Mathers***, ***Jakubovics***, ***Meechan*** and ***Steele***. These are built on strong relationships with local and national media facilitated by a proactive press office. We also have engagement with science in schools (*Jakubovics*) whilst nutrition and oral health researchers both worked with adults (controversies in personalised nutrition; infection spread app) and with schoolchildren (discover DNA in foods; what's hiding in your mouth) during the British Science Festival (September 7-10, 2013). Both Centres are supported by engagement support co-ordinators as part of the Faculty of Medical Sciences Patient and Public Engagement Strategy. COHR has had its own engagement strategy in place since 2010 with a dedicated lead.

c. Strategy and plans

COHR has a three part impact strategy. First we target policy relevant work. Given current strong relationships with government and NHS organisations, and the policy links that flow, we have identified research streams in health economics and health services research where there are ways of informing either policy or practice directly. We have taken steps to ensure that early career researchers are furnished with the appropriate skills to ensure the work is of high quality and aligned to policy concerns (see People section in Environment Statement). Second we collaborate with key partners organisations, especially where we need to work on a large scale to ensure findings are sufficiently robust to implement. For example, large-scale trials are best delivered co-operatively, but at a local level we invest energy and resource in maintaining good secondary care clinical research facilities and primary care networks to ensure we are well placed to undertake the complex trials that will directly impact practice. Third we will target specific commercial partners where the opportunity fits best with our expertise and our portfolio of work. This is particularly around diagnostic and preventive technologies where we will seek to develop fair and honest relationships, ensuring delivery of high quality science and advice. Seeking support for early career researchers is a cost-effective strategy to ensure good value for partners and good training.

In the HNRC, our strategy is to sustain our defined research focus on ageing and obesity and to attract funding that takes basic discovery to impact, a recent example being the NIHR funded work and NIHR chair awarded to ***Adamson***. This, in turn, attracts the attention of stakeholders including industry, government, NGOs and the public. To facilitate translation of our more basic research into societal benefit we will pursue an intensive programme of dissemination of both our on-going research and research outcomes to relevant target audiences. Recent examples include presentations on "nutrition and healthy ageing" given to the Food & Drink Federation and to Age UK (***Mathers***). We have invested to create a Food & Consumer Research Facility (*nu-food*– opened 2013 (described in UoA6)) providing excellent facilities for food-based research for HNRC researchers and, through contract/collaboration, with external organisations. This facility will enhance greatly our capacity to interact with food and other nutrition and health-related companies.

d. Relationship to case studies

Government policies generally have impacts with wide reach, and our public health and health services work is conducted with this in mind. The path to policy changes described in the impact case on dental policy started decades ago with epidemiological trends being demonstrated many years later. The policy changes that we can show responding to this work will develop over decades and the benefits will persist for a lifetime. In the food labelling case study, we illustrate a major policy impact in a very high profile aspect of nutrition related to obesity. In both cases individual publications and a wider body of work by the researchers led to the policy impact. The case study on sedation guidelines illustrates the pathway from trials in primary and secondary care to patient benefit through guidelines reflecting our wider work in health care services. The many commercial relationships we report will take time to progress to market or to public action but demonstrate clearly our intent across the UoA. Some societal and public health impacts related to the cases may be difficult to quantify but will have had considerable reach and significance. For example, our media work aims to improve the public understanding of the science that underpins the policy case studies, and so to improve public buy-in to healthy behaviours.