Institution: University of Bristol

Unit of Assessment: UoA3

a. Context

The School of Oral & Dental Sciences (UoA3) - The School leads multi-disciplinary research in laboratory, clinical and population sciences. The research in these areas is based around three research groups: Infection & Immunology, Applied Clinical & Materials Sciences and Lifecourse Epidemiology & Population Oral Health. The research groups and laboratories are located alongside clinicians facilitating close working relationships between clinical and non-clinical researchers and supporting a successful programme of training for clinical academics.

Realizing impact through collaboration - The research in the School reflects and links to excellence across the University with each of our three research areas mapping onto University themes in *Infection & Immunology*, *Nanoscience & Quantum Information* and *Population Health*. The UoA collaborates with the two other Schools within the Faculty of Medicine & Dentistry and across the University. For example, the Bristol Nutrition Biomedical Research Unit based in the School is a partnership between four University Schools. Our UoA3 has two academic staff and several core staff working across UoAs 1 and 2 and we have a policy of inter-UoA academic mentorship to encourage multi-disciplinary working and to establish and maintain research networks.

UoA3 impact - As the research in our School is both rich and diverse, the range of impacts and the groups that benefit are wide ranging. The types of impacts include 1) development of tools, clinical or laboratory techniques and knowledge, relevant to users, which we validate and place in the public domain (international peer-reviewed literature) to achieve the widest possible coverage; 2) expert advice to Government, charities, and industry, with a demonstrable impact on policy and commercial activity; 3) engagement with the public through mainstream and social media; 4) changes in professional standards, behaviour, and healthcare provision; 5) improved clinical outcomes for paediatric and adult patients; 6) training the next-generation world class clinical scientists and clinicians (including Continuing Professional Development training). The people and groups that may benefit include Governments, regional healthcare providers, major multinational companies, smaller UK or overseas enterprises, charities, healthcare consumers, future students, and the general public.

b. Approach to impact

UoA3 support for Impact - The School provides a supportive environment for staff (Athena SWAN Silver Award, April 2013). We have also introduced specific measures to encourage staff to focus on the impact of their research. We appointed an Impact Champion (Ness) who has raised awareness of impact across the whole UoA with meetings and workshops, shared best practice, and provided support for staff. We have encouraged staff to undertake training aimed at enhancing Impact, such as leadership and management programmes, media training, coaching in research commercialism. This has resulted in the appointment of one of our staff as a Faculty Business Fellow (Su), public engagement activities (Jenkinson, Waylen), and the submission of patents (Barbour). We have fostered industrial collaborations by allowing academics the time to develop connections and providing the resources (time, space, funds and administrative support) to make these connections successful. This has resulted in new partnerships between academic staff and industry e.g. Peptide Therapeutics (Middleton), Medcell (Su), Kemdent (Barbour). We have worked closely with the University Research Enterprise and Development office (RED) to support development of Impact. Through working closely with RED our staff have successfully bid for a wide range of University managed competitive funds (Alumini and Faculty funds, EPSRC Institutional Support, and Materials Sandpit) aimed at accelerating impact (e.g. Barbour, Nobbs, Su). Furthermore, the Severnside Alliance for Translational Research Bio-E initiative has funded research into biomaterials promoting tissue growth (Su, Middleton) for clinical use.

Partnership with multi-national pharmaceutical companies - We have continued to work closely with multinational pharmaceutical companies such as GSK, Colgate, Oral B and Procter & Gamble. We have developed tooth wear models (West) that are now a key stage in the testing of new products, e.g. desensitizing pastes for alleviating pain. The expertise in Bristol (led by West) has resulted in extensive industrial collaboration. New anti-tooth wear and hypersensitivity products supported by our research are now sold in advanced and emerging markets in over 100 countries and impact on 40% of the adult dentate population.

Links with smaller biomaterials companies - We have built relationships with smaller companies such as Kemdent, Biomet and The National Physics Laboratory. We have developed antimicrobial compounds to protect surgical prostheses from infections. Work on novel surfaces, antimicrobial peptides and nanoparticles, subject of a recent patent application (Barbour), have been generated through Research Councils UK (RCUK)-supported industrial partnerships. The preliminary work was seed corn funded by University *Pathway to Impact*, *Materials Sandpit* and *EPSRC Impact Accelerator Awards*, and has led to a new £330K EPSRC grant award (Su, Nobbs).

Development of applied research capacity - Seven years ago the School set up a population research group - the Lifecourse Epidemiology & Population Oral Health group. The aim was to create a group that could carry out experimental and applied research and in so doing strengthen our ability to conduct research specifically resulting in benefits to people with disease. The group is supported by an NIHR funded programme, and NIHR-funded projects, and now hosts the Biomedical Research Unit in Nutrition, Diet and Lifestyle including Obesity. This was awarded in 2012 to the University of Bristol and the University Hospitals Bristol NHS Foundation Trust, and is designated Bristol Nutrition BRU.

Patient public involvement (PPI) - We have set up or worked with existing patient groups in all of our areas of applied research. We have done this to ensure that all research is relevant and responsive to the needs of the people being studied and likely to produce results that will impact on their lives. For example, the Bristol Nutrition BRU has agreed a formal PPI policy and set up groups to support studies in men with prostate cancer and people undergoing colorectal surgery.

Conducting policy relevant research - We supported a Clinical Standards Advisory Group (Sandy) that reported in 1998. Our research informed the centralization and reconfiguration of services for children with Cleft Lip and Palate (CLP). This has resulted in improvements in the care and outcomes for children in the UK and across the world. We have continued to support the ongoing process of centralization in the UK (and internationally) and obtained funding to carry out a national evaluation of this process that has just been completed. Furthermore, we are currently developing an online resource (Research for Patient Benefit funding) for families affected by CLP (Waylen) that will also help support training of health care professionals and potentially identify unmet clinical need.

Supporting clinical innovation - We support innovation in our clinical staff. For example Dr Robin Mills invented a novel curing method for hardening of composite dental filling materials by arranging a number of LED (light-emitting diode) devices into an array and sinking the heat. This approach cured more efficiently and deeper than conventional halogen-based methods. The method was patented and the patent assigned in 2009 was purchased by Phillips.

Active dissemination of results - We encourage staff to sit on strategy boards and funding panels to help disseminate our results and expertise. These include the National Cancer Research Network (Thomas), DoH Research Strategy Board and UK BioBank (Sandy), Healing Foundation Research Council (Sandy), UK Clinical Research Network (Ireland), NIHR Research for Patient Benefit (RfPB) Regional Funding Committee (Ireland), and Wellcome Trust and BBSRC research funding panels (Jenkinson). We also disseminate our findings through our multi-disciplinary research communities both within and outside the University.

Public engagement - We work closely with the University Centre for Public Engagement (CPE) to ensure that findings from our research are accessible to members of the general public. For example, we have widely publicized our research linking oral microbial infections with cardiovascular disease (Jenkinson) through various media (national TV, Radio 4, newspapers, international websites, monthly magazines, public lectures). Publicity for our Healing Foundation Gene Bank and Cohort Study was enhanced by a recent (Nov 2013) Royal visit by HRH The Countess of Wessex. We also help promote careers in science. For example, we exhibited hands-on to 7-18 yr-old students of the future at Big Bang, Excel London (Nobbs).

c. Strategy and plans

Strategy - Our aim is to ensure that the importance of impact is recognized across all areas of research in the UoA to provide the support necessary to maximize the impact of our research. We will continue to follow the approach outlined above but will strengthen this as described below.

School impact plan - The impact champion (Ness) will set up a working group (Jan 2014) to develop a formal 5-yr Impact Plan for the School. This plan will seek to ensure that research excellence translates into impact by identifying training needs, sharing examples of good practice from across the UoA (and University), providing support and mentorship for staff at all stages on the pathway to impact and monitoring the development of impact in the School.

Broadening our industry partnerships - With the award of the Bristol Nutrition BRU there are opportunities to broaden our links with industry and develop partnerships in new areas (companies include Data Plastics, Syngenta, Astra Zenica, Biomet and Stanmore Implants). We will pursue these opportunities by visiting new and established key industry partners, inviting industry colleagues to present at seminars and by running joint training events.

Expansion of patient public involvement (PPI) - Following on from our success of working with the Cleft Lip and Palate community we intend to expand our PPI so that we have groups that cover all aspects of our research and that our PPI groups all directly consider impact. Specifically we intend to set up a PPI group for the School to advise on research and impact across the UoA.

The Elizabeth Blackwell Institute for Health Research - We will work with the recently created University of Bristol Elizabeth Blackwell Institute for Health Research. The aim of this Institute is to build a dynamic community of researchers from health and non-health related disciplines to find innovative solutions for some of the most pressing health challenges of the 21st century. This will allow us to extend our multi-disciplinary networks and offer funding opportunities to support impact. For example, we are already working with members of the EBIHR on a major project funded by the EPSRC entitled Sensor Platform for HEalthcare in a Residential Environment (SPHERE). This is a £12M award led by Craddock in the Faculty of Engineering at the University of Bristol.

The NIHR Collaboration for Leadership in Applied Health Research and Care West (CLAHRC West) **-** We will work with the recently awarded CLAHRC West (£9M) that brings together universities, local authorities, NHS Hospital Trusts and Clinical Commissioning Groups to focus on improving health and healthcare for local people. The CLAHRC will work through Health Integration Teams (HITs). These are cross-organization interdisciplinary groups set up to harness research, innovation, education, patient care, and prevention strengths, to tackle major health priorities. For example, we are already part of one HIT - *Bristol Inequalities in Early Years Health and Wellbeing.* This HIT will address the issue that 7.5% of Bristol children have a chronic or potentially disabling condition that impacts on their daily lives. We will identify local needs, evaluate health inequalities, and deliver improved models of care for children and their families. Key outcomes will be reduction in hospital admissions for tooth extraction and uptake of preventive health initiatives.

d. Relationship to case studies

The impact case studies illustrate the success of the approach to impact that we have adopted, with support from University resources e.g. RED, CPE. They show that we have always ensured that our excellence in research has translated into impact and ultimately benefited people.

CLP case study - illustrates how our focus on policy relevant research, active dissemination and patient and public involvement (working with the Cleft Lip and Palate Association) has resulted in important changes to service provision. Our recent investment in applied research capacity allowed us to secure funding to evaluate this process of centralization.

Tooth Pain case study - is a result of our long-term commitment to build partnerships with multi-national pharmaceutical companies based on our expertise, facilities and collaborative approach.

Surgical Feeding case study - shows how our long-standing interest in nutritional interventions and our links to excellence in population science and research methodology (including systematic reviews) has resulted in an important change in surgical practice. We have strengthened our ability to carry out research in this area in the future with peri-operative nutrition included as one of five research themes within the Bristol Nutrition BRU.