Institution: University of Bristol

Unit of Assessment: U0A4 – Psychology, Psychiatry and Neuroscience

a. Context

Bristol University is a major centre for the cognitive and brain sciences. Expertise is broad-based, allowing us to deliver a wide impact portfolio. The submission includes academics working in the following groups: Cellular and Molecular Neuroscience, Systems Neuroscience, Psychological Science and Clinical Neuroscience; based in the following academic schools: Physiology & Pharmacology; Experimental Psychology and Clinical Sciences.

Bristol Neuroscience (BN) was founded by the University of Bristol in 2003 to strengthen and coordinate this community in Bristol. In 2012 Bristol University founded a major new initiative, the Elizabeth Blackwell Institute for Health Research (EBI) which BN is now part of. EBI provides the opportunity and vehicle for BN to develop even wider cross-disciplinary links across heath related area and into the natural and physical sciences.

Major areas of impact and their beneficiaries include:

A. **Clinical:** Improvement in clinical outcomes for paediatric and adult neuroscience patients
B. **Industrial:** Provision of new methods and compounds to the pharmaceutical industry, designs for medical device manufacture, and evaluation of ingredients for the food industry
C. **The Public:** A public more informed about and engaged with neuroscience and psychology

The City of Bristol, and the region, provides a rich environment for this UoA to achieve significant wide reaching translation and impact. Bristol is a major centre for medical care with four NHS trusts, coordinated by the Bristol Health Partners, with specialist services in Neurosurgery, Neurology, Paediatric Neurology and Psychiatry. Some of the academics submitted to this UoA also hold clinical appointments in these trusts and so are, as a result, an engine for translating scientific discovery into patient benefit. We also work closely with *@Bristol,* a registered charity and one of the UK's leading science and discovery centres.

b. Approach to impact

Our approach to impact focuses on the pipeline from basic discovery, through nurturing translational work, to mature impacts that deliver significant benefits to stakeholders. This pathway clearly varies with the nature of the impact, but all impacts are supported by common principles or steps that:

1. Facilitate and encourage interaction between the scientist and impact beneficiaries
2. Provide the support required to sustain, grow and measure impact
3. Reward and celebrate success in delivering impact

In 2010 BN launched the Bristol Neuroscience Strategic Plan, in which the first (of five) objectives is to *Drive a translational agenda that ensures that fundamental neuroscience research delivers benefits to society.* This clearly articulates both our aspirations and commitment to health related impact.

1. Facilitate and encourage interaction between the scientist and impact beneficiaries

A. Clinical

Researchers working in the Clinical Neuroscience group combine NHS responsibilities with clinical research and hence are working continuously at the impact interface between neuroscience research and patient care. For example, the Clinical Neuroscience Group is integrated with the clinical Multiple Sclerosis (MS) team in Bristol, which delivers clinical care to some 1500 MS patients. As a result the group have been able to carry out a number of Phase 1 and Phase 2 clinical trials as well as coordinating a number of conventional industry-driven pharma trials. Similarly, another clear illustration of the translational pipeline in the UoA is provided by the research/clinical team who work to improve the clinical outcomes for preterm babies and neonates with brain damage. The group uses laboratory animal models to investigate mechanisms and develop interventions. As well as the work described in detail in the "Therapeutic hypothermia saves thousands of babies each year across the developed world from severe disability or death" case study, this group studies the mechanisms by which intraventricular haemorrhage injures the brain and produces hydrocephalus in pre-term infants. This has been investigated in animal models and in human infants and has led to a neurosurgical intervention (Drainage, Irrigation and Fibrinolytic Therapy) that has been shown in a randomised clinical trial to reduce severe cognitive disability at 2 years. An on-going randomised trial is investigating early vs. late intervention in

infants and, if successful, we will strive to have this treatment recommended by NICE and adopted internationally.
To strengthen the link between clinicians and basic scientists BN organised six workshops in the review period to focus on patient need (topics including: Dementia; Movement Disorders; Sleep and Deep Brain Stimulation). In 2010 NHS and UoA research leadership was brought closer together with the appointment of Wynick, a University Professor and Neuroscientist, as Research Director across the two NHS Trusts.
A particular research strength of the Psychological Science Group in the UoA is typical and atypical child development. To strengthen the links between our research and children with various developmental disorders, in 2009 the School of Experimental Psychology became a formal trust partner in Fosse Way Special School with a member of the UoA sitting on the Board of Governors and taking an active role in the running Fosse Way.

B. Industrial

The UoA has for many years had established and very close relationships with Industry (see for example the three case studies in this area). Within the review period our interactions with the pharmaceutical industry has been further strengthened via the **Severnside Alliance for Translational Research (SARTRE).** SARTRE was created in 2009 between the Universities of Cardiff and Bristol to combine and accelerate our efforts in translational research and to provide a focal point for interactions with external partners such as Bio-Pharmaceutical companies. SARTE was funded by a £3.9M grant from the MRC and the Wales Office of Research and Development. SATRE facilitates the clear impact that the UoA has in the pharmaceutical industry through the provision of new methods and compounds for drug discovery and evaluation. We maintain a broad based relationship with this sector including industrial collaborations with Ascent, Janssen, Pfizer, Johnson and Johnson, Astra Zeneca, GSK, Novartis, Lilly, Organon. We have a particularly well developed collaboration with Lilley through the involvement of a number of staff (Collingridge, Jones, Mellor, Jane, Lodge, Ashby) in the Lilly Centre for Cognitive Neuroscience. This includes development of new chemical research tools and adoption of novel *in vivo* and *in vitro* electrophysiological techniques developed in Bristol by Lilly, which are central to their neuroscience drug discovery programme.
The **Bristol Vision Institute (BVI)** brings together scientists from Engineering, Psychology, Biology and Neuroscience with an interest in Vision with industrial partners including the BBC, Aardman, Dolby and the broader creative sector. It organises regular industry focused workshops and a regular seminar series.

C. The Public

Public engagement activities have important impact by bridging the gap between researchers and the public. Activity based on research in the UoA can help both adults and children understand why they (and others) behave as they do and can change the public's view on societally important issues (for example, mental health). BN has a sustained program of public engagement activities to achieve this impact on society. Major activities in the review period include: Brain Awareness Week (Bristol, 2008-2014; >1000 visitors per year); Cheltenham Science Festival. (2008, 2009); The Creative Brain Autumn Public Lecture Series (Bristol, 2008-2009), speakers included Lord Puttnam, Paul Nurse, Lord Winston, Colin Blakemore, Jonathan Miller, Richard Gregory, Semir Zeki, and AS Byatt; Movies and the Mind film festival (Watershed, Bristol, 2009), a 4 day event with over 250 attendees per day; 10th anniversary of BN event (2013), a major 2 day event involving keynote presentations, local schools and a public science experiment. In 2011, the Royal Institution Christmas Lectures were delivered by Hood.

2. Providing the support required to sustain, grow and measure impact

A. Clinical

For many years BN has provided the mechanisms to support and grow the clinical impact of the UoA's research and this has been a particular strength of the organisation. Within the assessment period substantial new support for the translation of science to patient benefit comes from **Bristol Health Partners (BHP),** which was launched in 2012. BHP is a collaboration between the four NHS Trusts serving the Bristol area, the city's two universities and the local authority. BHP has a program of forming Health Integration Teams (HITs) which are cross-organisation, interdisciplinary groups set up to tackle major health priorities in an integrated manner. HITS provide a direct mechanism for research to have an impact in patient care and for the clinical needs of patients to change the research agenda. Within the UoA there are currently two HITS. The first is *Joint*

Working for Dementia led by Coulthard. The HIT is currently running the first prospective national trial of an angiotensin II antagonist in early Alzheimer's Disease funded by MRC and managed by NIHR. The second HIT is in *Parkinson's Disease and other movement disorders* led by Whone. This HIT is coordinating an MRC-funded phase I trial of intracerebral convection-enhanced drug delivery of carboplatin for treatment of brain tumours, and a Parkinson's UK-funded randomised control trial of CED of glial cell-derived neurotrophic factor for Parkinson's disease.
To support the translation of basic science to patient care, BN, in collaboration with Bristol University Institute for Advanced Studies, runs a Translational Neuroscience Research Fellowship scheme funded by a donation made via the University's Alumni Foundation. Using teaching buy-out, fellows are able to spend extended time in a local clinical setting. Four Fellowships have been awarded in the review period (Apps, Leonards, Robinson and Munafò). For example, Apps used the Fellowship to develop a collaboration with Edwards, a paediatric neurosurgeon, to develop an intraoperative method to reduce postsurgical problems following resection of cerebellar tumours in children (the second most common cancer in children). This has led to external research funding by Action Medical Research to carry out a feasibility study of this potential treatment.

B. Industrial

Within all Schools, impact strategy and activity is coordinated by the Impact Director within the Research Committee, and these activities are supported by University funded Business Fellows. CASE and Industry funded PhD studentships are a major mechanism to support research with the potential to deliver rapid impact, as the research agenda is shaped by the goals of the external organisations. The University has well developed mechanisms to support working with industry via the Research and Enterprise Development Office. This is particularly important where work requires substantial contractual, IP and legal support. For example, Rogers and Brunstrom work with the food industry in the evaluation of ingredients and study of consumption behaviour. In the review period £1.02M in funding for this work has come to the UoA directly from industry from companies such as Unilever Group, GlaxoSmithKline, Nestle and Kraft Foods and has changed the food products we eat at a national and international level via the evaluation of novel food ingredients.
The BVI has developed the BBC/EPSRC funded joint laboratory to support projects between members of the UoA and other media companies (including BBC, Dolby and Aardman Animation) to develop and study the next generation of visual displays.
The UoA also provides an environment that encourages entrepreneurial activity. For example, Munafò and Penton-Voak are directors of Jericoe Ltd. a start-up company involved in cognitive assessment and mental health interventions, who work in collaboration with industry leaders (Cambridge Cognition) and leading charities (The Mental Health Foundation). Gilchrist is part of the Bristol based start-up consultancy company, Prime-Decisions, which deliver consultancy on human decision making.

C. The Public

The University Public Engagement Office provides expert support and advice on all levels of public engagement activity and has worked as a partner with BN on all its major public engagement activities and provided tools for engagement evaluation.

3. Rewarding and celebrating success in delivering impact

The Vice-Chancellor's Impact Award was initiated in 2011 to acknowledge and reward the most innovative and successful examples of research impact. The 2011 award was won by Thoresen for her work in Neonatal Neuroscience. In 2011 Anne Cooke, Neuroscience Facilitator, was awarded the University Engagement Award for her pioneering public engagement work in the neuroscience community. The 2012 award was won by Hood for his public engagement work. These awards acted as an incentive for members of staff to define and quantify their impact. Our impact activities have also received external recognition. Gage, a PhD student within the UoA, was 2012 joint winner of the UK Science Blog Prize. In 2013, BN and the School of Experimental Psychology were named in the STEM Ambassador Awards as 'STEM University Department of the Year' for their outreach work. In 2012 Headley was acknowledged in Parliament for his significant contribution in advising government on formulating the new EU Directive on the use of animals in research [Hansard 3/12/12].

c. Strategy and plans

Our impact strategy is focused on the common principles and steps outlined in section b and

building on BN's core strategic objective to *Drive a translational agenda that ensures that fundamental neuroscience research delivers benefits to society*.
The recent establishment of the **Elizabeth Blackwell Institute for Health Research (EBI)** is a key new opportunity for members of this UoA to support and shape impact activity. Neuroscience is one of the EBI's three major research strengths (with Cardiac Science and Population Health) and will receive increased support from staff within EBI. EBI will facilitate translation of basic science to clinical practice and industry and has been part-funded by a Wellcome Trust Institutional Strategic Support Fund with matched funding from the University (£440k spend to date on projects in this UoA). EBI provides pump-priming and targeted funding, especially for research at the interfaces between disciplines, through the following schemes: Catalyst Fund (Pump-priming awards for interdisciplinary research); Early Career Fellowships; Women Returners to Work Scheme (funded research fellowships following a career break); Clinical Primer Scheme (to fund clinical graduates to undertake a 6-month research project); Senior Fellowships. Collaborations with external partners (e.g. industry, SMEs, universities, NGOs etc); Capital funding. The EBI also incorporates Bristol's role in SARTRE and provides a focal point for interactions with Bio-Pharmaceutical companies.
BN, as one of the founding pillars of the EBI, will continue to encourage contact between scientists and beneficiaries of impact and will also continue to organise events to bring basic scientists together with clinicians and patients to focus on a disorder or disease. SARTRE, through the EBI, will promote this interface with industry, and the HITs within BHP will ensure that these research efforts have a real impact on clinical care.
The EBI will provide the support and infrastructure required to measure, sustain and grow impacts at all levels of maturity; providing support for start-up and spin out companies and research facilities to act as a research provider to companies. Support will continue for all levels of public engagement from small local talks to a television show like the Royal Institution Christmas Lectures (delivered by Hood in 2012), that reaches many millions of viewers.
We can only have sustained impact when there are lasting relationships between all members of the team in this impact pipeline. This is achieved by a number of well established and emerging organisations within Bristol (BN, BHP, EBI, SARTRE, and BVI) that cut across the basic science, applied science and user groups as outlined above.
Finally, we will continue to reward and celebrate success in delivering impact. The University has a long history of valuing and rewarding such activity, and the community submitted in the UoA have won 3 of the 4 awards made in this area by the University in the review period.

d. Relationship to case studies

The eight submitted case studies illustrate the spread and depth of our impact across the three domains outlined in this document:

A. **Clinical:** Improvement in clinical outcomes for paediatric and adult neuroscience patients:
   (1) Therapeutic Hypothermia saves thousands of babies each year across the developed world from severe disability or death
   (2) Artificial cervical joint improves patient outcome, reduces healthcare costs worldwide and benefits business
   (3) Influencing international tobacco policy on standardised tobacco packaging
B. **Industrial:** Provision of new methods and compounds to the pharmaceutical industry:
   (4) Developing new toothpastes to improve wellbeing for people who suffer with sensitive teeth
   (5) Development of chemical probes leads to economic benefits for biochemical suppliers and industry investment in drug development
   (6) Consumer protection and commercial impact of proven ineffectiveness of a food ingredient designed to aid appetite control
C. **The Public:** A public more informed about and engaged with neuroscience and psychology:
   (7) The 2011 Royal Institution Christmas Lectures: changing the public's understanding of the mind and brain
   (8) Innovative approach to assessing drug harms has major impact on government policy and public awareness