Institution: Cardiff University

Unit of Assessment: 4

a. Context

***Structure*:** Cardiff University UoA4 research is conducted by two groups within the College of Biomedical and Life Sciences. One group is the School of Psychology. The other is the MRC Centre for Neuropsychiatric Genetics and Genomics (hereafter MRC Centre), which is part of the School of Medicine. The two groups are now co-located on the central University campus and there is extensive interaction and collaboration between the groups. This is underpinned by a strategy of making joint senior appointments and by a number of joint projects and grants.

***Research*:** UoA4 research underpinning our impact encompasses a broad range of clinical and non-clinical areas of enquiry, spanning biological, psychological and social approaches. Our research extends from the biological foundations of animal and human behaviour to key psychological issues of broad importance to society, such as attitude and behaviour change, reproductive health, perceptions of risk, and optimising safety and performance at work. In the domain of mental health our research ranges from the genetic and environmental predispositions to, and triggers of, mental illness to studies of service delivery and therapeutic interventions.

***Beneficiaries*:** The main non-academic beneficiaries of UoA4 research are *policy-makers and practitioners* in environment, health, safety, and energy policy, including the *National Health Service*, *government agencies* (HSE, DVLA) and *government departments* (DWP, DECC, DEFRA, DoH, MoD); charities working to understand and treat autism, bipolar disorder and other mental health problems, and those working to promote sustainability and the alleviation of poverty; *industry and commercial partnerships*, especially pharmaceutical companies, aerospace and defence companies, the maritime industry, energy companies, and SMEs working on brain imaging and neuroscience interventions; *patients and their families*; and the *general public*.

***Impacts*:** Our impacts can be seen in policy, service delivery and clinical practice in health; policy and practice in the environment; on the ways in which charities campaign to change behaviour; on drug development; on safety practices in working environments; on policy and practice in energy companies; on product development in neuroscience SMEs; and on the knowledge and behaviour of members of the general public.

b. Approach to impact

The *School of Psychology* has a longstanding tradition of conducting applied research and actively encourages (through annual appraisal and targeted investment) its staff to develop relationships with non-academic users, and through these relationships to attract input and investment. The model that we follow is one in which users and beneficiaries are regarded as stakeholders in our research, rather than passive recipients of research findings. Where appropriate, users are invited to become members of research advisory boards. A prime example of this approach is the Wales Autism Research Centre (WARC). Their approach to impact is through equal partnership working; for example, in their current knowledge exchange grant “Integrating research and practice” WARC researchers have co-developed an online forum with one charity, and with two other charities they have created a “Research Toolkit” on autism interventions for policy makers.

Research in *MRC Centre* is motivated and informed by the clinical experiences of the senior investigators who provide clinical specialist services to patients in Wales and beyond. Close integration of clinical and research activities shapes research direction and informs service provision. Within the MRC Centre, research, laboratory and strategy meetings bring together clinical and non-clinical researchers so that all research is embedded within a clinical, translational context. The work of MRC Centre is supported by NHS Biomedical Research Centre funding for Wales’ National Centre for Mental health (NCMH). The NCMH is an integral component of the NHS R&D structures in Wales and provides a translational focus for our work on mental health.

The School of Psychology and the MRC Centre have too many relationships with users to list exhaustively here; we illustrate our approach by providing examples from different user categories.

UK and devolved policy-making bodies. The Understanding Risk group conducts research on public responses to climate change and energy use and much of its research has a direct bearing on national policy and practice. Members of the group have formed extensive relationships with policy-makers at national and devolved government levels, sit on national Science Advisory

Committees (Govt. Office of Science, Dept. of Energy and Climate Change, Dept. for Environment, Food and Rural Affairs, Welsh Government), and have been invited in the assessment period to provide expert evidence to Parliamentary Select Committees, UK Ministers and UK Foresight projects. Members present findings to a variety of policy audiences (Westminster, Scottish and Welsh governments, business, 3rd sector). Targeted users from these sectors are also engaged as a matter of course in the group's project advisory panels. A dedicated website provides an additional vehicle for user engagement (www.understanding-risk.org). The active involvement of Cardiff researchers in policy, guidelines and advisory committees helps to ensure that our research informs health policy and guidelines at all levels: local Health Boards, the Welsh and UK Governments (including NICE, the National Institute for Health and Care Excellence); and international organizations such as WHO, the World Health Organisation.

***Charities*.** The Wales Autism Research Centre (WARC) was initiated through a unique collaboration between the School of Psychology, the charities Autism Cymru and Autistica, Cardiff University and the Welsh Assembly Government. The close involvement of the charitable and government sectors in the work of WARC is reflected in the fact that Autism Cymru, Autistica and the Welsh Government are represented on WARC's Advisory Committee. Sue Leekam, the director of WARC, is also a trustee of Autism Cymru. Again, there is a dedicated website (http://psych.cf.ac.uk/warc/) that promotes user engagement. We also have close relationships with BipolarUK, Action on Puerperal Psychosis and Hafal, as noted below under *Patient Groups*.

***Industry and commercial partnerships*.** Members of Cardiff University Brain Research and Imaging Centre, led by Chris Chambers**,** received funding from the Academic Expertise for Business (A4B) and Knowledge Economy Skills Scholarship (KESS) programmes to develop concurrent transcranial magnetic stimulation (TMS), magnetic resonance imaging (MRI) and electroencephalography, working in close collaboration with Welsh companies Magstim and Dymed. Magstim and Dymed have been closely involved in this research from the outset, as reflected in joint publications (*Neuroimage*, *Journal of Neuroscience Methods*) and several innovations in hardware and software for concurrent TMS-MRI.

Commercial partnerships enhance the translational impact and wealth generation potential of our research. For example, we are partners with Janssen in the Severnside Alliance for Translational Research (SARTRE; http://www.sartre.ac.uk), with the objective of developing novel drug target validation strategies. We also collaborate closely with the SME, Smile-On, to develop multi-media educational material for bipolar disorder patients. We collaborate with CAL2CAL Corporation in developing a computerized predictive and monitoring tool for adolescent depression to be used by general practitioners in their routine clinical practice. We are part of the Lilly Centre for Cognitive Neuroscience, a consortium of academic and industrial neuroscientists seeking to enhance the probability of clinical success for molecules targeted at conditions involving cognitive dysfunction. Within our neuropsychiatric imaging work we have close links with equipment manufacturers and software companies, including General Electric Healthcare and the SMEs Braininnovation and Brainproducts for developing new hardware and software.

***Patient groups*.** Crucial to our approach is communication between research teams and beneficiaries. For example, Nick Craddock and Ian Jones are scientific advisors to the patient support group BipolarUK, write regularly about research in its journal, *Pendulum*, and co-organize annual meetings and workshops. The bipolar disorder research team communicates regularly with its 6000+ research participants (the Bipolar Disorder Research Network) via newsletters, emails, mailings and meetings. The psychosis research team has a similar relationship with Hafal (Wales' version of Rethink), for which Mike Owen and James Walters are scientific advisors. The patient support charity, Action on Puerperal Psychosis, was established by Ian Jones, who is its Chair and Nick Craddock its Scientific Advisor. Julie Williams was Senior Scientific Advisor to the Alzheimer's Society. As well as informing the research agenda and approach, these communication channels ensure that patients, carers, relatives and relevant 3rd sector organizations are informed about research findings, facilitating earlier and greater clinical impact.

***General public*.** The Fertility Studies Research Group conducts work of direct relevance to members of the general public who are trying to have children or plan to have children. The group engages with the public by promoting the use of fertility tools such as FertiSTAT to improve awareness of the signs, symptoms and preventable causes of fertility problems in women's magazines (UK: *Red*; Portugal: *Visao*; Japan: *FRaU*) and public health initiatives sponsored by

national governments (e.g., in Belgium http://www.testjevruchtbaarheid.be/). We also communicate research findings through a range of public education and engagement activities aimed at increasing understanding of mental illness and the implications of research, thereby helping to reduce stigma and improve services. For example, we work with the science discovery centre, Techniquest, to enable children to explore findings about our recent ADHD genetics research (PI: Anita Thapar) and we work with artists on exhibitions and installations that feature pieces of artwork that depict neuroscience research about mental illness (funded by the Wellcome Trust).

Unit support and Institutional facilities

We fund researchers to travel to workshops aimed at developing links with users. We also provide technical support for the Understanding Risk website and sponsor links to online tools such as FertiSTAT, enabling members of the public to get individualised feedback about their fertility status. The University supports the FertiQoL website <www.fertiqol.org> where clinicians/industry can download the tool that measures quality of life in individuals experiencing fertility problems. The University also supports the translation of FertiQoL (25 languages) via its Translation Centre. For the development of concurrent TMS-MRI (A4B & KESS), CUBRIC (our brain imaging facility) ensured sufficient provision of MRI scanner time and TMS laboratory space, as well as requisite computing facilities and software for analysis of MRI data.

Pathways to innovation and engagement are facilitated through the TIME (Translation, Innovation, Methodologies and Engagement) Institute, established in 2011, which acts as a focus for delivering translation through training, identifying opportunities for innovative and entrepreneurial aspects of research, developing clinical trial design and delivery, and delivering cutting-edge technology and infrastructure. Co-alignment of R&D strategies and management structures between University and NHS Health Boards enables UoA4 researchers to be informed by, and deliver impact to, NHS Services in Wales and beyond. Commercial initiatives are facilitated through the University's Research and Commercial Division and the University's intellectual property development company, Fusion IP, which provides advice and start-up funds for researchers who wish to exploit the commercial potential of their work.

c. Strategy and plans

Strategy: We seek to realise the translational impact of our research by developing closer and stronger relationships with users and beneficiaries, so that we better understand their needs and they better appreciate the applied potential of our research. We will enhance our impacts by developing and maintaining strong links with users and beneficiaries such that they can influence the research we do as well as how we apply our findings to realise benefits for people and society.

Goals

- To increase the proportion of our portfolio of funding that is aimed specifically at translational activities that will improve human physical and mental health, either directly by working with individuals or indirectly by working with government, the NHS and industry to effect change.
- To attract more investment in our research from users and beneficiaries, including co-funding from external sponsors for research projects and PhD studentships.
- To develop a 'Biobank' of over 6000 patient volunteers by the end of 2014 (baseline clinical data, DNA and consent for follow-up through clinical records). A related objective is to enhance the utility of the Biobank by linking to electronic records within Wales and developing a web interface to enhance the translational benefits of the Biobank.

Plans for supporting and enabling impact

Dissemination to and training of researchers

- We have designated 'impact champions' who report to their Directors of Research. The impact champions support and advise colleagues in all aspects of research impact.
- All researchers, from research students upwards, are encouraged to reflect on the non-academic impact of their research, to identify ways of increasing that impact, and to develop robust methods of monitoring and recording this impact.
- The impact plans of all researchers are a fixed item for discussion at annual appraisal meetings. Where training needs are identified with respect to impact, researchers will be financially supported to attend courses and workshops that meet those needs.

Communication with and dissemination to stakeholders

- Guided by an External Advisory Board that includes stakeholders, we will exploit a range of

ways (e.g., websites and videos, Open Days, and invited visits by 6th formers) of making our research results known to policy makers, industry, 3rd sector bodies and the general public.
- We will use the National Centre for Mental Health (NCMH) as a way to attract patient volunteers willing to participate in future studies into mental illness, and extend the NCMH approach to encompass a broader range of neuropsychiatric disorders.
- We will continue to use the NCMH website as a way to provide information about disorders, treatments and training materials and tools developed from our research.
- We will use key performance indicators against which to evaluate research impact activity, such as number of patient volunteers on our Biobank database; number and size of commercial trials; number of hits and downloads of information sheets and training tools from our websites; media coverage; number of attendees at educational events; citing of our research in policy documents.
- We will build on our existing links with stakeholders, such as government agencies, charities, health service providers, and companies such as EADS, QinetiQ, General Dynamics (UK), and will continue to engage in MoD programmes on Human Capability.

Resources to support and enable impact

- We will make funds available on a selective basis to support efforts to develop or monitor the impact of their research.
- We will exploit external funding opportunities to increase our research impact, such as Knowledge Transfer Partnerships, Knowledge Economy Skills Scholarships, and BBSRC Activating Impact Awards.

d. Relationship to case studies

The selected impact case studies were chosen from a broader portfolio of research that has impacts on public health, mental and neurological illness, health and safety at work, and sustainability and the environment.

Case studies 1 (cannabis use and psychosis) and ***2*** (psychological debriefing) illustrate the way in which Cardiff research influences policy discussions and practice guidelines. Other research of this nature includes imaging and clinical research that informed the latest classification of the American Psychiatric Association, DSM-5, for mood and psychotic disorders and phobias; research on tools used to diagnose autism that informs DSM-5; and work on how antenatal and postnatal depression affects child wellbeing that informs SIGN guidelines. Cardiff genetics research was cited by the Director of the US National Institute of Mental Health in his high profile criticism of the descriptive DSM psychiatric diagnostic approach and his call for a move towards use of biomarkers and dimensions (http://www.nimh.nih.gov/about/director/2013/transforming-diagnosis.shtml).

Case study 3 (maritime safety) exemplifies a longstanding tradition of research in the School of Psychology on applied issues in the workplace. Other research of this nature includes detailed analysis of the effects of background sound on cognitive performance, which has influenced the development of office-noise technologies by a number of manufacturers (e.g., Ecophon, Herman Miller); training and interface design with defence and aerospace companies; and research on stress at work, where much of the approach taken by the Health and Safety Executive is based on research by Andy Smith's Centre of Occupational and Health Psychology.

Case studies 4 (fertility tools) and ***5*** (health checks for adults with learning disability) exemplify the range of the unit's research on public health issues, extending from fertility issues to forensic research (on adult psychopaths and young offenders), domestic abuse, and developmental disorders (autism, aggression and conduct disorder).

Case study 6 (evidence-based intervention for bipolar disorder) illustrates the ways in which the unit's research includes clinical research (in this case on an intervention) and subsequent development and delivery in collaboration with a commercial company. Other research of this type includes clinical cohort research that has developed in commercial collaboration (with Cal2Cal software company) computer tools for the prediction of depression (http://ncmh.info/tools/) as well as patient/ family educational materials (http://ncmh.info/factsheets-and-leaflets/).

Case studies 7 and 8 exemplify a considerable investment in work relating to the environment in general and climate change in particular, and show how this work has an impact on government policy (Case 7), and campaigns conducted by charities and NGOs (Case 8).