Institution: University of South Wales

Unit of Assessment: C26

a. Context

Impact themes: The Unit focuses on two functionally-integrated clinical and applied impact themes that reflect long-standing interests in Vascular Health and Sports Performance. The Vascular Health Group (**Bailey**, **Evans**, **Fall**, **New, Ainslie & Richardson**) focuses on the pathophysiology of atherosclerosis and the vascular benefits associated with increased physical activity and healthy eating across the ageing continuum. The Sports Performance Group (**Mullen**, **Brugniaux**, **Nelson** & **Williams**) makes use of extensive collaborations with elite sports teams and takes a practical approach to improving sports performance and participation. The Unit achieves impact with research because it deliberately and consistently works with others who share this commitment and help ensure that the work is informed by the needs, aspirations and challenges facing practitioners, policy-makers and key users.

Non-academic user groups, beneficiaries & audiences: As vulnerable key users especially prone to atherosclerosis, the main beneficiaries targeted by the Vascular Health Group include the elderly and further extend to those with "accelerated vascular ageing" including obese, diabetic, stroke, chronic mountain sickness and aortic abdominal aneurysm (AAA) patients. Those associated with the Sports Performance Group include elite athletes though an emerging target population stimulated by the promotion of physical activity through sports participation initiatives involves school children. Both Groups collectively seek to widen public engagement to generate community interest by encouraging individuals to engage in physical activity and promote healthy eating with the ultimate aim of improving their functional quality of life. Thus, additional non-academic user groups, beneficiaries and audiences for this research include policy makers (eg **Bailey** with NHS, **Brugniaux** with the International Olympic Committee), media organisations (eg. **Bailey** with newspapers, TV and radio), science festivals and public engagement groups (eg **Bailey** at Cheltenham Science Festival, Royal Society of Chemistry, Learned Society of Wales), social media outreach events (eg **Bailey** with I'm a Scientist Get me Out of Here!), community groups including schools and Governing Bodies (eg **Bailey** with British Triathlon Federation, British Boxing Board of Control & British Paralympic Association, **Brugniaux** with the International Olympic Committee & **Mullen** with the Football Association & Football Association of Wales) and healthcare workers (eg. **Bailey** with NHS).

Impact type: The primary impact of the Unit's research falls into the categories of health and welfare with "translational impact" on culture, society, environment and public policy. The novel detection and molecular identification of free radicals serves as new and emerging biomarkers of health and well-being. Much of this research has international reach, though it is equally important to recognise the unique reach and impact associated with regional research conducted within Wales given the prevalence and severity of vascular disease which is amongst the highest recorded in Europe; an unfortunate fact that the Unit takes full advantage of. Senior appointments to Research Networks have provided a conduit to local government stimulating critical debate and helping shape policy and practice in terms of encouraging physical activity and healthy eating. By linking international quality research with regional practice/policy-making through shared research initiatives, workshops, seminars and conferences involving the elderly and diseased patients, the Vascular Health Group has directly impacted on the health and wellbeing by improving an individual's functional quality of life "spreading the benefits of exercise as a cheap and effective medicine". These practices have raised public awareness to the complications associated with sedentary ageing with the aim of challenging cultural beliefs and altering ingrained behavior through the promotion of physical activity and healthy eating across the ageing continuum (see Impact Case Study 1). **Bailey** and **Brugniaux**'s intermittent hypoxic training work exemplifies how excellent research can inform international policy, practice and evidence-based regulation, shaping the IOC's decision to endorse its practice as a legal and safe means of enhancing sports performance. Olympic athletes have taken full advantage of this research, highlighting its impact during their preparations for the 2012 London Olympic Games (see Impact Case Study 2).

b. Approach to impact

Engagement with key users and evidence: The diversity of the Unit's research impact reflects the genuinely multidisciplinary nature of its clinical/applied expertise and testifies to the

collaborative and outward-looking ethos that underpins the research culture (see REF 5). The Unit's approach to impact is unified by its commitment to sharing work with local communities and key users, providing meaningful, practical benefits arising from fundamental research. The Unit achieves this in a variety of ways:

Impact through collaboration to target key users: The Vascular Health Group has actively sought to make strategic alliances with NHS staff, in particular vascular surgeons to gain access to diabetic, stroke, AAA and peripheral arterial occlusive disease patients as clinical models of accelerated vascular ageing. This has been stimulated through formal presentations at local NHS conferences (eg **Bailey** who was awarded best presentation at the Cwm Taf Health Board) and involving senior staff (eg Prof M Lewis, senior consultant vascular surgeon studying a PhD supervised by **Bailey**) to engage in postgraduate project supervision and collaborative research. **Bailey**, **Brugniaux**, **Fall** and **New** are providing research input into the Wales AAA Screening Programme which has had a remarkable impact on patients' quality of life and life expectancy (see Patient Testimonials, http://news.bbc.co.uk/1/hi/wales/8676071.stm). Furthermore, the Unit has developed sound working relationships with local fitness centres (including inception of sponsored public "Fat Camps"), sports clubs and recreation centres to promote and indeed justify from a mechanistic perspective, the vascular health benefits of physical activity amongst local comminities. The Sports Performance Group has developed lasting relationships with several National Governing Bodies including British Cycling, British Boxing Board of Control, British Paralympic Association, Welsh Rugby Union, Football Association & Football Association of Wales, & British Triathlon Federation. Their athletes have taken advantage of the Unit's research infrastructure including novel intermittent hypoxia training paradigms that have made material contributions towards several world-leading sports successes (see Impact Case Studies 1 & 2).

Impact through leadership: Further access to vulnerable patient populations has been stimulated following appointment of members to the Stroke Steering Group of the Older People & Ageing (eg **Bailey** and his PhD student Christopher Marley: http://www.opanwales.org.uk/team.htm), Cardiovascular Research Group Cymru (eg **Bailey**: Cardiovascular Physiology Lead under the Vascular Biology and Arterial Disorders Research Development Group: http://www.wales.nhs.uk/sites3/page.cfm?orgid=949&pid=52205) Research Networks.

Impact through consultation: Access to key users has contributed towards patient-centred design of research through the Involving People Network (http://www.wales.nhs.uk/sites3/page.cfm?orgid=1023&pid=59258), underpinned by the belief that "active" involvement/consultation of members of the public leads to research that is more relevant and more likely to be used to improve health and social care services. A similar approach was undertaken with several of the athletes to optimise preparation for London 2012 Olympic Games.

Impact through dissemination : Staff are actively encouraged to develop dissemination strategies in an attempt to optimise impact "reach" including science festivals (eg **Bailey:** Cheltenham Science Festival: http://www.cheltenhamfestivals.com/science/whats-on/2013/will-humans-evolve-in-the-future/), social media outreach events (eg I'm a Scientist Get Me out of Here!: http://humanj13.imascientist.org.uk/profile/damianbailey/), popular books that target the lay public: http://medex.org.uk//medex_book/about_book.php, presentations through established bodies (eg. Learned Society of Wales and Royal Society of Chemistry: http://learnedsocietywales.ac.uk/cy/node/450), community presentations (eg Swansea Science Café http://www.swansea.ac.uk/science/swanseasciencecafe/, broadcast media (eg BBC: http://www.walesonline.co.uk/news/health/researchers-play-high-altitude-rugby-matches-2047833; http://news.bbc.co.uk/1/hi/wales/7506400.stm http://news.bbc.co.uk/today/hi/today/newsid_9612000/9612622.stm) and government (http://www.geolsoc.org.uk/sata).

Support: The Unit's impact agenda has been vigorously supported across the University through a comprehensive programme of investment, professional administrative support and research staff/student development (see REF 5). For example, the University's Commercial Services Office and Research Office support KTP and Knowledge Catalyst projects and the Welsh-Government funded Strategic Insight Programme that facilitates staff exchange between HE and industry help encourage and enable staff achieve impact. Bespoke Faculty staff are employed to make contact and nurture relationships with non-academic users, collaborators and key users, supporting the development of impact elements of the Unit's research project design and offering organisational

assistance in hosting events that are geared towards achieving impact through exchange and debate. Further institutional support has been provided by the University Research Investment Scheme and the Unit has consistently benefitted to support potentially high-impact projects (eg **Bailey**, **Brugniaux, Mullen** & **New**'s doctoral studentships to examine the neuroprotective benefits of physical activity and weight loss for brain health/promotion of physical activity amongst schoolchildren through sports participation, which have since become priority developmental areas for future investment, as outlined in REF5). Dissemination is facilitated by the Marketing Dep^{t} helping "connect" academics globally through media, web, blogs and publications (eg **Bailey**: http://profile.glam.ac.uk/media/files/documents/2012-07-11/TALENT_Spring_Summer_20121.pdf).

c. Strategy and plans

The Unit will continue to encourage members to fully exploit opportunities for the development of translational impact arising from clinical and applied research. Its Impact Strategy will ensure that it is recognised by non-academic users as an accessible source of international research excellence with tangible benefits for "patients-to-performers" in Wales, the UK and beyond. The Unit will achieve this by:

Developing existing and formalising new collaborations with non-academic users who offer meaningful routes to impact for research. The Unit will extend its key user-centred research activities (eg **Bailey**: Involving People Network and **Mullen**: Sports Governing Bodies).
Continuing to invest in Research Groups to provide a funded base for expertise in knowledge transfer exploiting strategically-aligned "impact themes" that address "Health and Wealth" challenges currently facing society.
Continuing to communicate exciting science to the lay public through outward-facing research activities that will sustain and foster international networks with science festivals, practitioners and media organisations so as to facilitate a broad reach for future global impact (eg **Bailey**'s public outreach activities organised by the Physiological Society, Learned Society of Wales & Royal Society of Chemistry).
Supporting staff to continue to undertake leadership that can shape policy and practice (eg **Bailey**'s contributions towards writing of the OPAN Stroke Research Strategy government document 2013-2018).
Supporting doctoral students and ECRs through mentoring and further integration into Research Groups (eg via the Research Institute of Science & Health so members fully appreciate the nature and importance of the "impact agenda" and the ways in which they can gain impact for current and future research).
Integrating impact into the internal mechanisms for securing research funding by requiring all staff bidding for support to articulate the potential for impact which their research offers and the support they need to achieve it. Through the Research Institute of Science & Health, the Unit will commit to offering continuous staff development on impact pathways, offering workshops to develop "impact insight".

d. Relationship to case studies

The selected case studies exemplify how the Unit's high-quality fundamental research achieves translational impact and informs its strategic approach. Both case studies demonstrate the breadth and diversity of audiences, communities, organisations and individuals benefitting from the research and the significance impact holds in enriching the quality of life (from patients to performers) within Wales, the UK and beyond. They have been selected to highlight the Unit's multidisciplinary approach functionally integrating both clinical (vascular health) and applied (sports performance) impact; from bench to bedside to podium. ***Case Study 1***, ***"Free radicals and vascular ageing; move your muscles, move your mind!"*** provides evidence of how a novel technique associated with the biological detection/characterisation of free radicals has made an impact by informing the disease process, stimulating public policy and debate and by raising public awareness to the vascular benefits of physical activity, ultimately improved an individual's functional quality of life. ***Case Study 2 Intermittent hypoxia and its impact on human health: on mountains, medals and medicine!*** provides evidence of how the application of a novel model has achieved impact by informing the disease process and improving sports performance shaping international policy and practice, highlighted by the International Olympic Committee's decision to endorse intermittent hypoxia as a safe and legal ergogenic aid.