Institution: University of Essex

Unit of Assessment: 26 – Sport and Exercise Sciences, Leisure and Tourism

a. Context

Research within the Centre for Sports and Exercise Science (CSES) is undertaken to enhance sports performance amongst athletes, improve public health and quality of life, and to further public engagement in research. These characteristics generate extensive opportunities for impact, which CSES is proactive in exploiting by engaging with a range of external parties who share its goals, including: i) policymakers; ii) public sector organisations, such as local authorities and schools; iii) private sector industry; iv) elite athletes; v) NGOs and; vi) third sector organisations. These end-users are important stakeholders, maximising the impact of our research and, in turn, benefiting from the insight provided. The translational work of the *Health, Exercise and Active Life* (HEAL) and *Sport, Performance and Fatigue* (SPF) research groups is undertaken alongside the *Human Performance Unit* (HPU), which provides sports science support and testing, and the *Phoenix Club*, our phase IV cardiac rehabilitation and community exercise referral facility.

SPF collaborates with international companies in optical technology such as Artinis (NL) and Hutchinson Technology (US) as well as software and biosensor development companies such as HRV Fit Ltd (UK). SPF research both informs product design (e.g. waterproofing and fat layer correction for portable optical devices) and product testing (e.g. HRV algorithm validation for the *ithlete* mobile phone app). Products are then tested in elite and recreational athletes via external contacts such as the British Olympic Association and professional teams, and locally, via the HPU.

HEAL engages with a variety of stakeholders to share the concepts, principles and findings of its research. *Green Exercise* researchers are regularly commissioned to evaluate projects managed by external agencies, which inform the policies of NGOs, public and third sector bodies. These include environmental and health organisations such as MIND, RSPB, Natural England, Countryside Recreation Network, The Wilderness Foundation, Liverpool PCT, Essex County Council, Suffolk Wildlife Trust and Dementia Adventure. The *East of England Healthy Hearts Study* is the largest ever health and fitness survey of British 10-16 year olds. Key results of the survey were cited in the Chief Medical Officer's 2009 annual report calling for 'comprehensive fitness testing in English schools'. Charities (SusTrans) and companies (Kellogg's) commissioned specialised work to follow up the survey's impact. Research in the *Phoenix Club* led directly to three NHS projects evaluating community health impact (Anglia Community Enterprises). Exergaming research led to the use of the Nintendo Wii in fall prevention programmes in local hospitals (e.g. Colchester Hospital University Foundation NHS Trust). A research project analysing the change due to the implementation of the 'Productive Community Services Initiative' led to an overhaul of how community services were delivered in mid-Essex (midwifery, health visitors, speech and language therapy, physiotherapy, district nurses). Research work with NHS Mid-Essex PCT led to changes in physical activity programmes for people with learning disabilities.

Wider public engagement in our research is enabled via: media interviews and features on TV (e.g. BBC 1 Breakfast, The One Show, Sky News, ITN News, CNN, ABC) and radio (e.g. Radio 4 Today, World at One, the World Tonight); public appearances/demonstrations at festivals and events (Edinburgh, Cambridge and Manchester Science Festivals; Oxford and Edinburgh literary festivals, Bang Goes the Theory Live Show, Wellcome Trust In the Zone project); community events (Café Scientifique, WEA, RCUK's *Cutting Edge 2012: Behind Athletics,* Blue Peter Olympic Torch relay tour); and schools outreach (local, regional and national such as *I'm a Scientist: get me out of here*). The public are also engaged via: science web pages and blogs (e.g. www.runswimthrowcheat.com with >2,000 unique hits per month), as well as popular science books (Cooper: *Run, Swim, Throw, Cheat*, OUP) and opinion-forming feature articles (*Lancet, The New Republic, Huffington Post*). Individual members of SPF and HEAL have national media profiles (Cooper: EPSRC Senior Media Fellow; and Barton: Scientific Partner on Shock Absorber's *Get Out There* campaign, to promote the benefits of women exercising outdoors).

b. Approach to impact

The Centre's impact approach is integrated with that of the School of Biological Sciences (SBS) and the University as a whole. The School's Research Strategy Group is active in reviewing the Centre's impact policies and achievements and the School's Impact Director supports the integration and prioritisation of the impact agenda across research programmes. Impact, as well as

research excellence, is a factor in staff development (including promotions) and targeted University funding. The School's impact infrastructure provides financial support through its Research Promotion Fund: the *East of England Healthy Hearts Stud*y was completely funded in this manner, as were parts of the *Green Exercise* programme. The University supports staff in using research leave to enhance impact activities; in the REF period Gladwell (workplace health, Green Exercise), Griffin (exergaming) and Sandercock (school policy) included impact outcomes as part of research leave applications. The University recognises impact as a key factor in deciding the charging structure for the School's end-user-funded research, with lower overhead rates proving crucial to much of the applied work arising from Griffin's NHS collaborations.

CSES impact is primarily facilitated through partnerships with key research users, via a number of approaches, many of which are used in sequence or combination:

i) External end-user-funded research: Staff have been commissioned to undertake research on behalf of user groups, where activities are considered to be more *user-directed* than *user-informed.* In HEAL, this approach has proven highly effective in ensuring users are aware of appropriate and relevant research insight in Green Exercise, which can then be directly channelled into organisational policy and strategy. In SPF, the funding of equipment development by Artinis, and the use of this equipment in elite athletes funded by the BOA exemplifies this approach.

ii) Internal translational facilities: Both the HPU and the Phoenix Club enable SPF and HEAL researchers to access key participant groups to enable impact. Micklewright, Cooper and Parry have all used research as the basis of engagement with elite and club/recreational athletes via the HPU. Griffin and, especially, Sandercock use the Phoenix Club for pilot investigations of clinical work (e.g. Pilot investigation to determine event rates during cardiac rehabilitation exercise testing and training. *British Journal of Cardiology*, 2013) or to improve the evidence base for the efficacy of cardiac rehabilitation, particularly the assessment of patients' functional capacity before and after rehabilitation (e.g. Changes in Cardiorespiratory Fitness in Patients Receiving Supervised Outpatient Cardiac Rehabilitation Either Once or Twice a Week. *International Journal of Cardiology*, 2012). Historically, Griffin and Taylor have accessed local Colchester clinical contacts via the University's Essex Biomedical Science Institute (EBSI). This role has now been adopted by the *Ageing and Assisted Living Network*, a cross-disciplinary network of researchers established to promote innovative, multi-disciplinary research with the aim of improving the health and quality of life of older people and people with disabilities. This is enabling Griffin and Taylor to widen their interactions with end-users throughout the eastern region.

iii) Dissemination: This approach widens the audience of beneficiaries of research and is a means to draw in and strengthen relationships with user groups. CSES researchers have employed dissemination techniques directed towards four important groups: **a) research users:** the impact of much of Barton's Green Exercise work has progressed by invited presentations at conferences attended by both researchers and local and national government policymakers; **b) the media:** Staff are offered media training by the University's Communications and External Relations Office and encouraged to attend outside training offered by bodies such as the Royal Society and Science Media Centre. Cooper has taught on these courses and worked as an intern at the BBC Radio Science Unit. He and other senior academics offer mentoring to new staff. The Green Exercise (Barton, Gladwell) and Healthy Hearts (Sandercock) research projects actively use the media to share research findings with a wide audience, potentially influencing the policy agenda. Other members of CSES (Cooper) host events at the Science Media Centre (SMC) and are frequently engaged by the media via SMC-initiated contacts; **c) the public:** Researchers use their work as the basis of talks and demonstrations at public events and science festivals, enhancing public understanding. Feedback from these talks is frequently used to inform research e.g. Griffin and Taylor's presentations on the use of exergaming to community groups (such as the Multiple Sclerosis Society) informed the direction of their future research, and Gladwell hosted breakfast meetings with local business leaders, which informed the ideas that led to the Walks4work project; **d) key opinion formers:** Staff are also encouraged to join external networks, and to seek membership of advisory panels or project steering groups. One example is how membership of Natural England's *Outdoors for All* advisory group has helped to extend the impact of *Green Exercise* Research. Another is Cooper's Royal Society MP-Scientist exchange scheme with Stephen Metcalfe MP, a member of the House of Commons Science and Technology (STC) Committee. Exchange trips, including demonstrations of the latest research in a simple laboratory setting, resulted in suggestions that ultimately led to the House of Commons STC initiating a report

in 2011 on *Practical experiments in school science lessons and science field trips.*

iv) Commercialisation of research: The University's Research and Enterprise Office employs Research and Business Partnership Managers to assist departments in developing commercial impacts. The SBS has been particularly successful in attracting Research Council Follow-on Funding (100% success). Since 2008 CSES (Cooper) has been awarded two BBSRC Follow-on Funds and one Super Follow-on Fund (£1M) to support commercialisation of patented methods to enhance oxygen delivery to tissue. In 2013, Cooper also obtained an MRC *Developmental Pathway Funding Scheme* award, worth £1.2M, to support the project '*Engineering a new generation of blood substitutes*'.

c. Strategy and plans

The Centre's goal is to undertake research that can be used to inform and enhance human performance, health and fitness – both in sporting and public health contexts. Staff will maintain and extend their close links with research users, promoting the Centre's reputation and making use of its extensive facilities. Bi-weekly meetings of the Centre's staff, previously focussing on research funding and publications, will now introduce impact as an additional major consideration. Adopting the approaches outlined in section b, staff will aim both to **maximise the impact of *current research***, and to **integrate plans for impact into *future research***.

Plans relating to current research include (in the SPF group): using muscle optics to develop a diagnostic test in the *HPU* for the effect of training regimes on muscle oxidative capacity (Cooper) and *commercialising* aspects of basic research on optic flow technology to improve performance (Micklewright). HEAL group programmes will employ: *end-user-funded research* (Barton) to perform randomised clinical trials to determine the impact of Green Exercise on clinical outcomes (such as depression); the use of the *Phoenix Club* to optimise exercise strategies in chronic heart failure patients (Sandercock); and *commercialisation* (or *end-user-funded*) strategies to develop bespoke exergaming applications to decrease falls in at-risk groups (Griffin and Taylor).

Plans relating to future research: Potential impact outcomes will be integrated into the planning of future research from the outset. A relevant example is the application of ideas arising from Gladwell's Green Exercise research into direct testing of workplace health interventions (see: 'Walks4work: rationale and study design to investigate walking at lunchtime in the workplace setting', *BMC Public Health* (2012) 12: 550). Collaborations with the School of Computer Science and Electronic Engineering (arising from the exergaming project) will be used to explore the development of new technology arising from other projects, e.g. mobile apps to assist learning-disabled children in language development (Griffin). Collaborations with the School of Health of Human Sciences will be used to access a wider variety of local patients than are available from the *Phoenix Club*, enabling the exploitation of the expertise of Hettinga in rehabilitation research. For SPF, with three academics at the forefront of academic pacing research (Parry, Hettinga, Micklewright), we will endeavour to explore practical applications in elite sport.

d. Relationship to case studies

The Unit's case studies exemplify a number of approaches taken to realise impact from research since 2008. Optical Measurements of Muscle Physiology: Cooper's research underpinned development and application of near infrared spectroscopy (NIRS) devices that have been used in medical and sporting contexts. These impacts were enabled through Cooper's active approach towards collaborative research and network building. Both Government (EPSRC) and end-user (BOA, Hutchinson, Artinis) funding was used, with HPU expertise being key to both accessing this funding and developing the work. University funding was used to broaden the impact beyond the original end-users; e.g. as part of the School's 2009 Research Strategy, £20k was used to purchase four portable Artinis NIRS devices specifically to enable simultaneous work with multiple athletes and hence test teams such as Leicester Tigers Rugby Club and Team GB Hockey. Green Exercise: The impact of Green Exercise research was maximised primarily by using an effective model of user-funded research, complemented by wide-reaching dissemination. Researchers capitalised on their international reputation to attract external commissions for on-going work. The group undertook pioneering research directed towards specific challenges and issues identified by research users. This model has been highly effective both in sustaining and expanding research, and ensuring that its insight can be readily used to inform the policy and strategy of charities and NGOs. Dissemination has also been highly effective in widening the audience of stakeholders, as well as contributing to a paradigm shift in attitudes and understanding surrounding Green Exercise.