**Institution: Brunel University**

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

## a. Overview

Sport Sciences research at Brunel builds on a long and excellent tradition of combining social and natural sciences enquiry into sport. Our 200-year-old heritage can be traced back to Borough Road College that was inaugurated in 1798 and stood as the oldest teacher training college in the British Commonwealth. Momentum in research began to gather in the mid 1960s, but the period of greatest progress and dynamic change has been the past decade since the move of the subject area from Borough Road to the Uxbridge campus in 2002, and its establishment as Brunel University's highest quality-ranked research unit in RAE2008. This was followed by significant investment in strategic staff appointments and infrastructure during the 2008-13 REF assessment period to support our development as a leading multidisciplinary, research-intensive unit. We strive for excellence and wide-reaching societal impact through our research in the realm of sport, health and wellbeing. We are proactive in engaging with users and stakeholders, as well as addressing the changing political, economic and social landscape. All staff belong to one of our two complementary research centres in the natural and social sciences: the Centre for Sports Medicine and Human Performance (CSMHP), led by González-Alonso, and the Brunel Centre for Sport, Health and Wellbeing (BC·SHaW) led by Kay. The Sport Sciences Research Management Group (SSRMG) chaired by the Director of Research (Baltzopoulos) provides overarching strategic direction to maximise cross-centre synergies in the subject area, which is headed by Williams. We are accommodated in a single building that contains all Sport Sciences academic staff offices, PGR workspaces, laboratories and research support services, and fosters close integration and collegiality. This proximity benefits interactions among subdisciplines and provides substantive opportunities for collaboration.

In 2013, Brunel Sport Sciences hosts a vibrant community of 61 researchers that include five professors who have been appointed since 2010, 10 early-career researchers and 27 PhD students. The quality, significance and impact of our work is evidenced by the increased number of outputs that appear in high-impact outlets since 2008, significant increase (~50%) in research income (2001-07: £697k, 2008-13: £1.1M), and our participation in highly influential expert academic, policy and practice networks. In this template we describe the environment that has nurtured this increase in the scale, quality and profile of our research, as well as our future plans for addressing global challenges in sport, health and wellbeing.

## b. Research strategy

*Achievement of strategic aims and evaluation of RAE2008 strategy*

The main aim of our 2008-13 strategy was to become one of the leading Sport Sciences research units in the UK by achieving progress across four stated objectives: i) sustain and enhance quality research outputs, ii) increase income from external sources, iii) make a significant impact in academia, professional contexts and with the general public and, iv) increase our national and international visibility.

Our efforts to achieve these strategic objectives were facilitated by the identification of Sport Sciences as a priority for growth following our ranking as Brunel's top unit in RAE2008 based on GPA research quality scores. The University then embarked on a programme of investment in high-quality staff and the facilities necessary to support them. This included a critical mass of ECRs and the strategic appointment of new Chairs and a Subject Leader (Williams). These developments underpinned significant achievements under all four strategic research objectives including ~50% increase in external income to £1.1M but with marked acceleration from 2011 as the strategy for strengthening research leadership was implemented. Our achievement of strong impact across all audiences is evidenced by the diversity of our case studies ranging from commercial products for elite and recreational athletes to child protection and policy for development through sport. The subject area's achievements to 2013 and its future plans are based on the progressive development of our research structure. At the organisational level, we have built on the proven effectiveness of channelling all staff research activity through two specialist research centres in the natural and social sciences. This provides a framework for staff development and collaboration, and creates stimulating and vital research environments for researchers at all career stages. In the present assessment period we have developed this model,

focusing on establishing each centre as a hub of research excellence in its areas of expertise. This has required strengthening of research leadership, reorientation of the social sciences research centre to a wider research agenda, coordination through SSRMG, and the introduction of processes to support individual staff development and productivity. Both centres have actively engaged with academic forums, funders and research users to ensure the academic, social and policy relevance of their work.

*Future aims and goals and main strategic objectives over the next 5 years*
The subject area has a formal research development strategy that guides the activities of the two research centres and is aligned with the University Strategy and Transformation agenda to establish Brunel as a research-intensive institution. The main vision guiding the strategic research objectives for the next 5 years is to focus on our areas of research expertise and excellence and develop a critical mass of talented researchers that will drive further academic innovation, pioneering approaches and collaborations with international experts. These processes are essential for becoming a world-class centre of excellence in interdisciplinary and integrative approaches to research in sport sciences with important outcomes that will have significant impacts in practice, policy and behaviour. Our main strategic objectives to achieve these aims are:

1. Focus direction and priorities of research on areas of excellence and expertise (see priority development areas below) where we have critical mass and are able to maximise impact.
2. Support and further develop the function of our research centres through strong management structures to promote leadership and development opportunities for our researchers and enhance the research environment/infrastructure through integrated and purpose-built facilities.
3. Foster high-quality international research collaborations with top institutions and centres of excellence through innovative and pioneering projects in order to enhance our research environment and increase high-quality research and publications in top-ranked journals.
4. Diversify and increase external research income to include third-stream support from industry and international organisations by increasing external grant applications to research councils in the UK and Europe and other government funding agencies as well as industry.
5. Increase impact and public engagement through continuous consultation and interaction with public and private users and stakeholders of our research guided by specific personal and team impact plans.

*New and developing initiatives and priority development areas*
The establishment of the new Research Management Group in 2012 in addition to providing overall strategic direction also addresses staff development issues specific to the research agenda of the subject area. The SSRMG also has responsibility for evaluating the activities of the two research centres as well as monitoring the achievement of area-specific targets relating to each of these strategic objectives. Individual Annual Research Plans, introduced for all staff in 2011, are reviewed with Research Centre Directors and form part of staff annual appraisals.

The key development in the natural sciences centre (CSMHP) has been the establishment of state-of-the art cardiovascular, respiratory and biomechanics and motor behaviour laboratories and the associated infrastructure and systems with support from central University and School funding. In the social sciences, the key development has been the establishment of BC·SHaW in 2010-11 following a comprehensive review of the external and internal research environment. The centre builds on the robust academic foundations and strong research culture of the Centre for Youth Sport and Athlete Welfare formed in 2006 under Prof. Celia Brackenridge's leadership. The wider remit of BC·SHaW provides a more inclusive 'home' for the range of social science research undertaken in the subject area, and a more appropriate orientation to emerging research and policy agendas. The centre has quickly become recognised within relevant national and international research communities through the contributions of its members to working parties and expert groups, its impact on policy and practice, and its commitment to collaborative work with funders and research users. In addition to the research income detailed above, an extra £700k was secured recently by BC·SHaW for projects commencing in 2012-13 that will facilitate further developments and funding in these areas. Both centres are active in developing collaborations that can contribute to areas we would like to develop and have led a series of events in which world authorities along with potential collaborators debate and identify the fundamental research questions to be explored.

The CSMHP has identified priority areas and fundamental questions that need to be answered to advance current understanding of the functioning of the human body during exercise. Formal collaborative links have been forged with clinicians, permitting the initiation of pioneering invasive cardiovascular research and airway challenge studies. The Cardiovascular Physiology group aims to elucidate red blood cell-related mechanisms regulating skeletal muscle blood flow, and the role of muscle mechanisms and breathing in cardiovascular control. This requires exploring the physiological, cellular and molecular mechanisms regulating ATP release from human erythrocytes, particularly the role of temperature, exploring whether aerobic high-intensity interval training (AHIT) stimulates cardiac repair in patients who are post myocardial infarction and establishing the mechanism for this repair. The Respiratory Physiology group plans to explore the underlying mechanisms of inspiratory muscle training (IMT), and develop collaborations to stimulate changes in clinical practice. Respiratory limitations to be explored include the three mechanisms primarily under the control of the respiratory system; namely, arterial oxyhaemoglobin desaturation, respiratory muscle work/fatigue and cyclical fluctuations in intrathoracic pressure. These are all significant determinants of blood flow, arterial oxygen content and exercise tolerance.

The Biomechanics group is planning to use innovative imaging and modelling techniques pioneered in-house to study the basic mechanisms of *in vivo* muscle-tendon and joint function during maturation in children, young athletes and across the lifespan through our ageing research links. These techniques will also allow us to study the mechanisms underlying motor performance in order to improve training efficiency and performance in elite athletes. Our other objective is to reduce musculoskeletal loading and prevent injuries in athletes and among people with neuromuscular or musculoskeletal pathologies. The Cognition and Neuroscience group is focused on motor control and motor behaviour and is planning to identify the perceptual-motor skills underlying performance in expert, sub-expert and clinical groups. In parallel with this, the group will: determine the influence of stressors such as anxiety and physical workload/fatigue on perceptual-motor skills; develop simulation-based training programmes that facilitate development of the perceptual-motor skills; identify the mechanisms underpinning superior performance in visual aiming tasks such as archery and shooting; and identify the conditions that promote effective learning of perceptual-motor skills.

In the Social Sciences we are focused on enhancing the academic quality and significance of our research while maintaining its strong policy-relevance. This includes systematic further development of international collaborations. Four established areas have momentum and a fifth is earmarked for growth. (i) Our safeguarding research is buoyant, with two projects completed in 2013, further research funded to 2016 (Rhind, Kay, Hills, Brackenridge), and two new F/T doctoral studies underway (2013-16). (ii) Our sport and international development research has also secured funded long-term research projects (to 2018) and doctoral study (2014-17). We are initiating a major long-term research agenda across these two subfields through research into safeguarding children in low-income countries where they are most vulnerable. (iii) Under Mansfield, our health-related research has expanded rapidly (£373k of grant income since 2011 including ongoing projects and doctoral study to 2015) and is a priority for growth as well as securing research council and EU funding; this includes our specialist studies of music and physical activity (Karageorghis) for which we have established an international reputation. In each of the above three areas we are integrating doctoral study into major agency-funded research projects to ensure they directly contribute to academic development. (iv) Our well-established research in the sociology of sport is ongoing addressing sport and race sport and security, sport and gender, and sport development (Armstrong, Girginov, Hills, Mansfield, Testa). (v) Alongside these four established areas, we are developing a fuller programme of research in PE, coaching and pedagogy (Capel, Croston), where two staff have completed their PhDs in 2013.

We have more than doubled the volume of grant applications (~£2M /year) and we are working towards diversifying our funding streams and attracting more external support from industry, sport organisations, relevant medical charities in addition to targeting relevant themed calls from Research Councils and NIHR. Postgraduate research activity is considered central for achieving our potential and we plan to increase PGR activity around core research centre themes and staff research interests to increase critical mass in our areas of strength. Some staffing approaches to underpin our strategic aims include the recruitment of a policy analyst to further enhance academic

quality in our social sciences research, the increase of postdoctoral research capacity by attracting high-quality young researchers, increasing our number of young researchers and PhD students.

**c. People, including:**

**i. Staffing strategy and staff development**

The subject area aligns with the University staffing policies which aim to promote world-leading research by providing all staff with high-quality support appropriate for their career stage within an inclusive and collegial research environment. Strategic staff recruitment is core to the subject area's research strategy. The primary research criterion for all academic appointments is 3*/4* research profile/potential appropriate to career stage: (i) All full-time early-career appointments during the assessment period have achieved criteria for REF submission (2008 Kippelen, 2008 Rhind, 2009 Kinrade, 2009 Mohagheghi, 2013 Rakobowchuk); (ii) From 2010 the subject area adopted a targeted search policy to recruit expert staff of appropriate subject specialism to research leadership positions in the natural (2011 Baltzopoulos, 2012 Williams) and social (2010 Kay) sciences, including Mansfield (2011) to lead development of social sciences-led, health-related research. The University has made additional appointments to the subject area, including strategic appointments of existing long-term collaborators from top international institutions (2013 Beek, Hodges) to support development and institutional links for joint PhDs, ongoing projects and major grant submissions. In total, staff numbers expanded from 27 in 2008 to 35 in 2013 with 78% of FTEs submitted to RAE2008 and 90% submitted to REF2014. Like-for-like replacements have been fully supported, with Research Centres determining the research profiles required for new appointments. Staff retention has been high, with a small number of departures for further personal career advancement (Shave to a Chair at Cardiff Met; Hulston to a lectureship at Loughborough). The subject area has reinforced core research strengths through the appointment of young independent researchers (Kalsi, Physiology; Gonzalez and Young, Cognition and Neuroscience; Waugh, Biomechanics). Our recruitment and staff development policy is geared towards developing staff capacity, enabling their contribution to each of our strategic research objectives.

*Support for early-career researchers and development at all stages in research careers*

Brunel University recognises and values its research staff and was awarded the European Commission's 'HR Excellence in Research' in 2011 in recognition of its commitment to the recommendations of the Concordat to Support the Career Development of Researchers. Our Researcher Development Programme provides activities that mesh with the national Researcher Development Framework. The University Graduate School supports activities for research staff at the institutional level including researcher network forums, workshops, and personal and career coaching. Each of these activities is informed by the Careers in Research Online Survey. The subject area's support framework aligns with the principles of the Concordat and is designed to provide subject area-specific support, appropriate for the career stage of staff. Newly appointed lecturers are assigned a mentor, have reduced teaching and administrative responsibilities, and are allocated funds for conferences and equipment in accordance with a policy to provide them with the maximum support for their research. The research mentoring scheme includes twice-yearly meetings for each researcher with the director of their research centre (Kay or González-Alonso). Our two Research Centres offer a wealth of subject-specific activities for staff and students organised on a weekly basis. The Sport Sciences Research Management Group organises joint events (e.g. cross-disciplinary seminars) to bring all staff together and encourage interdisciplinary approaches to sport, health and exercise-related issues. Specialist speakers are invited to deliver additional sessions addressing overarching issues such as research impact.

The subject area actively promotes a team approach to research activities. Annual performance targets for professors and readers include requirements to collaborate with junior colleagues for research outputs and funding bids, and research centre budgets include annual allocations for conference attendance by early- and mid-career staff. Early- and mid-career staff with limited prior research experience have been supported to develop their research capacity; during the assessment period, several have obtained their doctorates (e.g. Kinrade, Rhind, Testa), increased their peer-reviewed outputs, participated in funding bids, and joined PGR supervisory teams.

Several of the subject area's ECRs have benefitted from the University's strong central support for staff development in research. Rhind's award of £10k in 2011/12 from BRIEF (Brunel Research

Initiative and Enterprise Fund) for research into child protection provided him with experience of managing a research project and three part-time research assistants. He also completed the University's Grant Academy for ESRC Future Research Leaders 2012/13 in which Brunel staff with research council funding experience provided workshops, feedback tutorials and mentoring to facilitate the development of a funding application. The subject area has also benefited from University provision for staff leave to support research development (Armstrong, Capel, Hills, Karageorghis, Korff, McConnell, Romer). Leave is used according to individual and centre priorities to support individual output, grant development, KTP and the furtherance of academic collaborations.

*Support for equalities and diversity and maintenance of standards of research quality and integrity*
All work in the subject area is permeated by a strong equality and diversity agenda. An Equality and Diversity Officer serves on the School's Research Committee to ensure equitable practice. Several specific measures are in place in the subject area to support early-career development and progression. These include an active policy of recruiting early-career researchers that dovetails with an active promotion initiative. The University has achieved an Athena SWAN Bronze Award for its efforts to promote equal opportunities for women in science-related subjects. High standards of research quality and integrity are maintained through formal and informal mechanisms for scrutiny:

- We foster a supportive research environment to nurture confident but self-critical researchers. All grant applications are reviewed internally by at least two internal independent reviewers. A specialist advisory group from SSRMG members provides advice and assistance to junior members of staff and help them to develop high-quality funding proposals. Regular research centre seminars and meetings provide feedback and advice from more experienced members.
- Ethical standards are enforced through the School Ethics Committee, which implements a well-developed process of ethical approval. A Health and Safety Officer works closely with the School's Research Ethics Committee (e.g. with obligatory risk assessments for all research projects).
- We benefit from our experience in leading research in challenging areas including work with children, victims of abuse, vulnerable people and in culturally sensitive contexts. The subject area also provides specialist programme of postgraduate student training related to ethical issues in sport research, reinforcing the PGR ethics education offered by the Brunel Graduate School.

**ii. Research students:**

| | 2008/09 | 2009/10 | 2010/11 | 2011/12 | 2012/13 |
|---|---|---|---|---|---|
| Registered Students | 27 | 30 | 32 | 30 | 27 |

The subject area has a long tradition of postgraduate scholarship and regards PGR students as central to the vitality and momentum of our academic community. Under our enhanced research structure we have sought to strengthen this core area of our work. The subject area has been proactive in recruiting PGR students that specifically support work around staff and Research Centre core themes, including building synergies with externally-funded contract research to ensure PGR work is fully integrated with these forms of research activities. We have increased supervisory capacity through staff training and new appointments. These approaches are already proving effective. From 2008 to 2013, there were 27 PhD completions and our PGR student population year-on-year is shown in the table above. There was also a clear increase in the quality of applicants, attracted by the increased profile of our researchers and research environment. Recent graduates have also benefitted considerably, showing an upward trend in the quality of research outputs and career trajectories. Many of these graduates have proceeded immediately to prestigious post-doctoral fellowships at overseas institutions such as the Mayo Clinic and the University of British Columbia in Vancouver, while others have taken lectureships at UK and overseas universities.

*The quality of training and supervision of PGR students*
At university level, all PGR students benefit from strong support through the Brunel Graduate School. This offers a range of tutorials, workshops and seminars as part of the Researcher Development Programme. Other support facilities via the Graduate School can be accessed 24 hours a day, 7 days a week. Graduate School support for part-time PGRs includes weekly coffee

mornings, monthly researcher teas and support through a Saturday school and collaborative workshops run jointly with UCL as well as other London universities. At subject level, the unit delivers training that complements the generic doctoral training provided by the Graduate School. There is also an annual induction programme for research students led by Karageorghis as the School's Deputy Head (Research) and a comprehensive training programme that has been progressively enhanced under the leadership of González-Alonso. Delivered since 2011-12 by all academic staff over 6 days p.a. (2 per term), the full programme provides a strong, integrated curriculum that reflects the multidisciplinary approach of the subject area. The quality of supervision is enhanced through the policy of appointing a supervisory team. These can only be led by a staff member who has already overseen a successful completion; the second supervisor may be less experienced. This provides broader support for students and facilitates staff development. The University has supported excellent candidates for research studentships through its Isambard Scholarship Scheme (Lindsay and Maitland). Vice-Chancellor Travel Prizes support conference attendance and are competitively awarded each year (e.g. Goodall, West and Gipson in 2008, Adams and Stohr 2009, Jones 2010 and 2012 and Theis 2011 and 2013). West received a Vice-Chancellor's Doctoral Research Prize in 2011/12 and Simpson a Brunel University Research Student Conference Prize in 2012/13.

*Strength and integration of postgraduate culture*

Research students make an outstanding contribution to the research culture of the School and are treated as junior members of staff. Their location adjacent to staff offices ensures daily interaction and complete immersion in the research environment. Specific collaboration and integration activities include:

- Coauthoring research outputs: a large proportion of research papers produced by Sport Sciences staff during the present cycle were co-authored/first-authored by PGRs;
- Collaboration on funding bids: experienced PGRs have contributed significantly to the preparation of funding proposals and have been named as co-applicants in grant applications;
- Appointment to current funded projects: PGR students are frequently employed to undertake fieldwork and data processing, and fully inducted into their performance of such duties;
- Participation in national/international conferences and specialist workshops hosted by the subject area.

Regular research seminars hosted by the research centres are scheduled for students to present at and receive feedback from their peers and staff in a supportive environment. Students can also take advantage of termly meetings with the School's Deputy Head (Research; Karageorghis) at which they are invited to feed back on their experiences. Research students are represented on the School's Research Committee and their contributions are acted upon by the research leaders within the subject area/School.

**d. Income, infrastructure and facilities**

Levels of research income exceed the previous RAE cycle by 50% and include grants from BBSRC, EPSRC, ESRC and Sport England. The level of research income generated by the subject area and the experiences/outcomes of research students are regularly monitored via the SSRMG and the School's Research Committee. In line with the Research Councils' increased emphasis on interdisciplinarity, the subject area has made appointments to enhance methodological expertise that supports collaborations across disciplines; for example, strengthening qualitative research in both the social (Mansfield [2011]) and natural (Rhind [2007]; Bishop [2007]) sciences. The benefits have resulted in an increased critical mass in the key research themes and successes in external funding in these areas. The establishment of state-of-the art facilities in biological sciences (including laboratories for invasive cardiovascular and respiratory work and recent investment in biomechanics and neuroscience equipment of £250k) is facilitated further through collaborations with other world-class Brunel University centres. These include the 3T *f*MRI unit and the Transmission Electron Microscopy unit for sarcomere-level muscle research. The infrastructure at our disposal through local collaborations allows us to pursue an ambitious, innovative and structured research strategy for exploring some basic mechanisms of physiological and biomechanical function and control. There have been several collaborations in recent years including shared use of laboratories between the subject area's physiologists and bioscientists from the School of Health Sciences and Social Care and between the subject area's

psychologists and the School of Social Sciences' Centre for Cognition and Neuroimaging. The subject area continues to develop its relationship with the University's PR company Communications Management. This association has considerably heightened the impact of the subject area's research activities. Work by McConnell (POWERbreathe® project) and Karageorghis (Run to the Beat™) have generated royalty streams for the University. Specific support that exists includes weekly seminar programmes, central funds for the development of research proposals, and the University's research/knowledge transfer leave scheme. There is scope for groups within the subject area to bid for equipment from a School fund in each academic year and an emphasis is placed on interdisciplinary/collaborative research in the awarding of these funds (in line with the School's research development strategy).

**e. Collaboration or contribution to the discipline or research base**

Our commitment to continuous improvement of our methodological and theoretical approaches and the in-house development of some of the most advanced techniques available allowed us to make some significant contributions to the research base of our rapidly-evolving fields.

*Natural sciences notable contributions to the research base*

- Peripheral vascular control: In recent years we have provided evidence that muscle mechanisms play a major role in the control of cardiac output in exercising humans. Our findings challenge the idea that the pumping capacity of the heart is the crucial factor determining $VO_2$max in humans. According to this new paradigm, cardiac output is compromised during exercise as a result of alterations in peripheral blood flow, rather than intrinsic cardiac limitations.
- Role of temperature in blood flow regulation: We have provided compelling evidence that temperature has a role in skeletal muscle blood flow regulation in part by stimulating the release of the vasodilator substance ATP from the erythrocytes. This newly discovered temperature dependent erythrocyte ATP release mechanism and the observations that muscle blood flow is also elevated (against the classic dogma hyperthermia only increases skin blood flow) opens the opportunity for using heating as a non-pharmacological means of increasing blood flow in elderly people with peripheral vascular disease or circulation problems.
- Cardiac remodelling: Our recent research is changing the way of thinking in this field based on the finding that AHIT may cause myocardial regeneration post-myocardial infract.
- Respiratory muscle function: The respiratory group has driven a change in attitudes towards use of IMT in sport and medicine that was achieved through challenging established dogma (e.g., CrossTalk debate in J Physiol), generating insights to support an alternative position, collaborating with international opinion-formers (Rik Gosselink, Marc Decramer and Denis O'Donnell) and a wide range of clinical researchers to establish evidence for new applications of IMT (Simon Brumagne, Sachin Kulkarni), and through development of superior products and publication of two practitioner-focused monographs.
- Respiratory limitations: By using a combination of peripheral (motor nerve stimulation) and central (transcranial magnetic stimulation) measures we have provided mechanistic insight into how the severity of hypoxia affects the relative contributions of peripheral and central fatigue to isolated-muscle and whole-body exercise tolerance.
- Anticipation and decision making: Our work on developing methods to capture these abilities is innovative and based on simulation and video-based training platforms to enhance anticipation and decision-making skills. Williams was invited in 2012 to present to a Select Committee of the National Academy of Sciences/National Science Foundation in the US on how this research in the area of expertise and simulation-training could inform the training of military personnel in the 21st Century.
- Exercise-related affect: Our work has provided compelling evidence for how auditory and visual stimuli can be used to enhance exercise-related affect beyond the ventilatory threshold; these findings have important implications for exercise adherence and health maintenance.
- Sports Performance: Our work on cycling (Korff with PhD student Barratt and Gardner from the EIS) has dramatically increased understanding of the biomechanical mechanisms underlying sprint performance in elite track cyclists. Work by Linthorne on sports mechanics and optimum projection angles in particular is now included in several leading textbooks for secondary school courses and introductory undergraduate university courses.
- Musculoskeletal *in vivo* function and biomechanics: Our EPSRC First Grant work (Korff) advanced understanding of the mechanisms that underlie child motor development through

challenging long-held assumptions regarding the central nervous system as the main driver of developmental changes in motor behaviour. The biomechanics group's research has revealed the shortening of the spastic muscle fascicle lengths in children with cerebral palsy (Mohagheghi), and is currently examining the effectiveness of therapeutic interventions such as stretching.

*Social sciences notable contributions to the research base*

- Contributions to the sociology of sport in the areas of football and race (Armstrong, Testa); sport and security (Armstrong); sport, physical activity and health, gendered aspects of sport, and qualitative methodologies (Hills, Mansfield); and sport development (Girginov, Hills).
- Sociologically-driven theoretical, methodological and empirical contributions from analyses of sport in the context of social policy issues: (i) safeguarding: leadership of international multidisciplinary primary and secondary research into the antecedents, correlates and prevention of forms of exploitation in sport. Methodological and theoretical contributions include Brackenridge's development of the activation states model, to assess organisational progress in implementing safeguarding policy. The Brunel International Research Network for Athlete Welfare (BIRNAW) founded in 2010 to foster international collaboration comprises > 50 active researchers in 16 countries by 2013. (ii) Sport and international development: participatory research to capture local subaltern perspectives to improve understanding of the contribution of sport to development goals; critical analyses of monitoring and evaluation (M+E) methodologies in sport for international development, including collaborative research to support local implementation of M+E (Kay); application of Brunel's expertise in safeguarding to sport for development (Rhind, Kay, Hills, Brackenridge); (iii) Sport and the health agenda: the UK and international Olympic participation legacy (Hills, Kay, Mansfield); research-practice partnerships to inform sustainable programmes to engage inactive young women (Hills), young adults in FE and HE environments (Mansfield, Kay), and inactive people (Mansfield) in sport; innovations in methodology to evaluate the contribution of sport to health through the incorporation of economic evaluation (Mansfield).
- Development of the Olympics knowledge legacy (Girginov) through a Podium-funded project on knowledge creation in the London Organising Committee of the Olympic and Paralympic Games; a two-volume edited collection on the London Games (Routledge 2012, 2013); Executive Editor of the Routledge special Olympic issue involving over 40 academic journals published by Routledge; by 2013 this had resulted in the publication of 174 papers by 308 authors from 19 countries.

*High quality research networks and collaborations with industry and other users of research*

The subject area has strong links with local NHS trusts, national and international governing bodies of sport, hospitals and professional sports clubs through which research findings are disseminated. Notably, the School's staff and research students have collaborated extensively with sport governing bodies. For example, in recent years, Williams has worked with the Premier League, FIFA, UEFA, EIS, UK Sport, GB Shooting, LTA, GB Archery (BBSRC award, 2012-15). McConnell has spearheaded the recent launch of the POWERbreathe K-Series products – the world's first electronic breathing muscle trainers. This work, which has generated a new patent for Brunel, originated from a knowledge transfer partnership with HaB International Ltd. The music-related work conducted by Karageorghis was adopted by the International Management Group (IMG) in the launch and development of the series of musical half-marathons known as Run to the Beat™ , and was also used to develop a series of associated compilation albums for the exercise market (with Ministry of Sound, Total Fitness Ltd. and City Showcase). The work by Girginov committed Routledge to a sustained Olympic-related publication programme. The impact of the LOCOG knowledge transfer project has resulted in the engagement of the Sochi 2014 Winter Olympic Games Organising Committee in supporting a similar project.

*National and international collaborations*

The outputs reveal a steady rise in the number of collaborations with highly ranked universities (e.g. Monash, Sydney, British Columbia, Vrije University, Iowa State, Copenhagen, Karolinska Institute, KU Leuven and Oxford, Loughborough, Leeds and Liverpool John Moores in the UK). The international research profile of researchers in Sport Sciences is also acknowledged through various awards (including the OBE for Brackenridge in the 2012 Queen's New Year's Honours), keynote or invited presentations to international conferences, contributions to many professional, scientific, governing body and clinical meetings, workshops and symposia and key international

collaborations. In CSMHP, Williams has an ongoing collaboration with scholars at the universities of Oxford and Birmingham (BBSRC-funded project) and Sydney (ARC-funded project). He has published with Anders Ericsson from Florida State University and Christopher Janelle from the University of Florida. He has also published extensively with Peter Beek from Vrije University Amsterdam and Nicola Hodges from the University of British Columbia over the last decade (both now appointed as part-time professors at Brunel). González-Alonso, has a long-standing research collaboration with the Copenhagen Muscle Research Centre (Denmark) that concerns integrative physiology of exercise, resulting in multiple world-leading research outputs. Baltzopoulos has collaborated and published with Maganaris from LJMU, Loram and Reeves from MMU and van Dieen from Vrije University Amsterdam. Korff has on-going collaborations with Jim Martin and the University of Utah.

In BC·SHaW, Kay has collaborative links in the UK with Such (Edinburgh), Fullagar (Bath) and Chawansky (Brighton), Spaaij (La Trobe, Melbourne), Jeanes (Monash, Melbourne), and Hayhurst (Toronto and Ottawa). Armstrong has collaborated with Peter Fussey and Richard Hobbs at Essex and Jon Coaffee at Warwick University on Olympic security and policing issues (the only ESRC grant linked to the London Olympics). Girginov has collaborated on several projects with colleagues from the universities of Loughborough, Sheffield, Oxford, Liverpool, Lancaster, Birmingham, Manchester, and Leeds. He also published with Kevin Hylton (Leeds Metropolitan University), John Gold (Oxford Brookes), Nils Olsen (George Washington University), Cora Burnet (University of Johannesburg). Mansfield has collaborations on health with Emma Rich (Bath), environment (Belinda Wheaton, Brighton), sociology of sport/sport and health (Dominic Malcolm, Loughborough) while Karageorghis has published regularly with Peter Terry from the University of Southern Queensland, Australia. In 2012, Testa was appointed Visiting Senior Research Fellow in sociology and qualitative research methods at the University of Bologna, Italy. Brackenridge has recently published with Kari Fasting (University of Oslo).

The subject area has organised a number of national and international conferences. In 2012 Sport Sciences led the consortium that organised the pre-Olympic Congress in Glasgow (International Convention of Science, Education and Medicine in Sport, 19-24 July). Brackenridge served as the Convention Convenor and Girginov as Deputy Director of the organising committee; the conference attracted 2000 delegates from 78 countries. The subject area also organised a successful BASES Conference in September 2008 which was hosted in our state-of-the-art indoor athletics centre and attracted 800 delegates. BC·SHaW hosts a biennial national Researching Youth Sport conference in partnership with the Institute of Youth Sport, Loughborough University.

*Indicators of wider influence and contributions to professional associations and learned societies*
Numerous members of Sport Sciences serve on the editorial boards of international journals. González-Alonso (editor, Journal of Physiology 2010-); Williams (Section Editor, Journal of Sports Sciences, 2004-; Associate Editor, Human Movement Science, 2010-; EB member Journal of Sport & Exercise Psychology, Scandinavian Journal of Medicine and Science in Sports, Frontiers in Cognition; Section Editor and Advisory Board Member, European Journal of Sport Science, 2004-11); Karageorghis (Sport and Exercise Psychology Section Editor, Journal of Science and Medicine in Sport, 2009-; EB member, Journal of Sports Sciences, 2006-); Baltzopoulos (Advisory Board, European Journal of Applied Physiology, 2008-; EB Isokinetics and Exercise Science and Sport Biomechanics,2001-); Jackson (EB Journal of Sports Sciences, 2013-); Romer (Physiology Section Editor, European Journal of Sport Science, 2004-); Kippelen (EB, British Journal of Sports Medicine; Mansfield (Book and Media Review Editor International Review for the Sociology of Sport, 2011-; EB, Leisure Studies Journal, 2012-; EB, Qualitative Research in Sport, Exercise and Health, 2013-); Girginov (EB, European Sport Management Quarterly); Testa (EB, Sport in Society); Kay (EB, International Journal of Sport Policy and Politics, 2010-; World Leisure Journal, 2009-). In 2012, Kay was appointed an Academician of the Academy of Social Sciences. Williams was a member of the ECSS Scientific Committee from 2005-11, Chair of the Motor Control and Learning Programme for NASPSPA 2012 and has been Secretary-General of the World Commission of Science and Sport since 2002. Kippelen was an invited member of the Independent Asthma Panel of the IOC–Medical Commission 2004-10. Five researchers (Brackenridge, Godfrey, Karageorghis, McConnell, Romer) were elected fellows of BASES. McConnell and Romer were elected fellows of ACSM, and Bishop and Karageorghis were elected associate fellows of the BPS.