High Performance Sport as a model for the acquisition, retention and retraining of an individual's skill base

BBSRC and UK Sport wish to encourage basic research on understanding the biological and psychological basis of skill learning and retention. This will address issues of common interest such as the improved maintenance of an individual's skill base and lead to improved training methodologies for elite athletes.

Background

The **Biotechnology and Biological Sciences Research Council (BBSRC)** is the country's leading agency for funding research and training in the biological sciences. BBSRC recognises we are in a period of unprecedented demographic change; with increasing lifespan there is the need to increase healthspan. Through its Delivery Plan BBSRC has recognised the need to maintain wellbeing over the lifecourse and particularly into longer periods of old age. An aspect of this maintenance is the capacity to align an individual's skill base over the lifecourse to promote physical health into old age and extend the working life of the individual. This issue is identified within the research challenges in the Strategy for Collaborative Ageing Research in the UK developed under the auspices of the Lifelong Health and Wellbeing Programme, and will require an understanding of the cognitive and linked physical processes leading to the learning and retention of skills, as well as the acquisition of new skills.

UK Sport is the lead Government organisation responsible for the strategic support and development of World, Olympic and Paralympic performance sport in the UK. As part of its current remit, it also provides the lead on research and innovation programmes run alongside the UK's leading sports coaches and athletes. These programmes are targeted in a number of key areas – one of which is related directly to human science and performance. UK Sport runs numerous talent identification campaigns and talent transfer initiatives to facilitate athletes in switching their specific skills into new sports.

Both organisations are keen to stimulate research in this area to the benefit of elite athletes as part of the legacy of the Olympic Games in 2012.

Key issue

Understanding how skills are learnt, developed, applied, maintained and changed over time is important both to top athletes and the wider population more generally. Elite athletes need to both maintain a wide range of skills, and have the ability to acquire new ones during the course of their athletic careers. Understanding how elite athletes are able acquire and retain their skills will inform on the broader population as it faces the prospect of longer working lives and the continued introduction of new technologies within the home, work, and wider environments.

<u>The acquisition and application of skills by elite athletes</u>
Although innate ability is important for athletic development, top athletes also need the ability to acquire and apply high level cognitive, perceptual and motor skills. These skills need to be acquired through physically and mentally intense learning processes. It may take 10,000 hours of practice to develop winning expertise; how that practice is structured, delivered and supported is critical to the outcome. A previous funding highlight between BBSRC and UK Sport explored the physiological basis of athletic performance. However, many successful athletes are notable for their ability to either develop additional skills, or acquire a new skill set replacing the original, and subsequently apply them at the top level of performance. This has become apparent with examples of talent transfer where athletes have been able to cross from one sport

into another with equal levels of success at the very top, or the rapid ability to change technique due to injury.

The acquisition of a skill and its application requires an individual to have the correct cognitive capabilities; understanding how these attributes interact is key to understanding how we develop a new skill. Whilst the characteristics required for learning a new skill are obviously not unique to high performance athletes, their focus on a very precise skill set and a high level of physiological capability, coupled with the opportunity to quantify athletic outputs, makes athletes potentially useful models for the study of skill acquisition. The ability of athletes to maintain their health at such an optimal level, and over a significant timespan, alongside an ability learn new skills at the same time, makes them potentially interesting models for the wider population.

Challenges

To study the acquisition, retention and retraining of an individual's skill base, BBSRC and UK Sport have identified three challenges that should be addressed to further understand skill acquisition in both high performing athletes and the wider population throughout the lifecourse. The purpose of the highlight is to encourage a multidisciplinary approach including the fields of neuroscience, biomechanics, motor behaviour, cognition, psychology, modelling, education, gerontology and management and business studies. To promote a multidisciplinary approach, the Economic and Social Research Council (ESRC) has agreed to provide co-funding for suitable applications which fall partially within its remit.

The following challenges have been identified:

- How does cognitive capability interact with the social and physical environment to influence the development of skill and expertise, and are there markers for skill acquisition?

  Issues of relevance to the athletic community and wider society include an understanding of the biological processes that underlie the ability to acquire and execute new motor and other skills, and using these as a marker to both optimise learning environments and understand how this changes over time. Issues to address could include:

  - Can we model these processes to predict and optimise performance outcomes, and expand the outcomes to the wider population?
  - What is the cognitive basis for the retention of skills across the lifecourse?
  - Is there a set or sets of markers that biologically indicate functional skill acquisition, and do these change over time and under different learning environments?

- What cognitive and psychological factors facilitate an individual's ability to maintain a high level of performance, and what affects an individual's resilience?

  Issues that could be addressed under this challenge may include:

  - Can we identify a cognitive basis for mental toughness and resilience – are there key psychological traits for repeat high performance and resilience in challenging environments?
  - Which factors contribute to an athlete's ability to manage psychological stress, willingness to pass through the pain barrier, and mental stamina for intensive training to increase performance? Such factors could relate to an athlete's ability to cope with the

stress of training, competing and ultimately using both failure and success constructively.
- Can we identify and validate methods to integrate neural, physiological, genetic or behavioural biomarkers to better understand or predict resilience for athletic performance and throughout the lifecourse?
- Can we use this knowledge to model options for training programmes - both physical and learning and over a lifespan?

- How do we optimise the retention, as well as the learning and retraining of skills by an individual to maximise the performance and flexibility of their skill base?

  In high performance sport, it has been shown that talented individuals from one domain can acquire the ability to perform at a high standard in a new activity. Refining a previous skill, or learning a new skill may be required to be effective in a new sport or wider activity.

  Issues that can be addressed under this challenge include:

  - Does athlete's previous skill acquisition help or hinder the process?
  - Is refining a previous skill a key component in transfer success or does it require a new learning pattern?
  - How does history and environment interact to influence skill acquisition? Are there key steps that are mandatory in the process?

  Understanding the processes involved could lead to a better understanding of the factors, both innate and acquired, that identify potential capacity to retrain, be it for sport or within a wider societal context. This could increase the effectiveness for example of talent transfer initiatives or re-skilling for a new work environment, and could accelerate skill-based learning through the development of training programmes. In a wider context, greater understanding could establish the relationship between such markers and the learning styles derived from established theories of learning in education and psychology.

BBSRC and UK Sport are keen to explore the above challenges as applied to athletes involved in high performance sport. This includes consideration of the full range of Olympic sports and involves athletes of all ages and backgrounds. It is anticipated that the study of athletes as a model system would lead to understanding skill acquisition at a broader level, and we are particularly keen to identify ways in which the resulting knowledge might be more widely applicable to other aspects of human activities throughout the lifecourse including, but not limited to, learning, teaching and training.

Applicants who seek to address the challenges above in athletes, and inform on improving an individual's skill base and healthspan within the broader society, are invited to submit to the 4 October Responsive Mode closing date. All proposals will need to address one or more of the above challenges; however it is not a requirement to incorporate cohort studies into applications.

<u>ESRC context</u>

BBSRC and ESRC recognise the importance of social context to the maintenance of an individual's skill base, the challenges presented in this context for an ageing population and the social nature of teaching, learning and training activities. Since individuals must learn and

maintain a broad range of diverse skills, and also have the ability to acquire new skills throughout their lifecourse in order to function successfully in a changing society, this topic is of particular interest to ESRC, and would contribute directly to its key priority area of Influencing Behaviour and Informing Interventions. Understanding the biological, psychological and social processes involved in human skill acquisition will also underpin the promotion of physical and mental wellbeing throughout the lifecourse, which is of interest to both councils.
This is a BBSRC highlight, however both councils are keen to engage the social science community within this call, and applications are expected to be primarily within BBSRC remit with contribution from the social sciences. Applicants proposing to include a social science component within the project should contact BBSRC in the first instance to discuss the proposed project, and advice should be sought from ESRC.

Timing and Process

Researchers who wish to develop ideas in this area are invited to submit a Letter of Intent (2 sides A4, Arial font 11).

Letters of Intent should be submitted through the JeS portal, using the Outline Proposal form (standard outline), identifying the call type as 'Skills Acquisition'. The Letter of Intent should be uploaded as an attachment in the 'Case for Support' section, indicating 'Letter of Intent' in the description.

Please include the following information:

- Details of the applicants (names and institutions)
- Duration of project
- Research aims and objectives
- A summary of involvement (if any) of athlete cohorts (please note that there is no requirement to involve athletes, we are simply facilitating the possibility of such studies if appropriate)
- Details of how the work will address the above challenges for athletes and for the wider population.
- Predicted impacts of the work for the athletic community, and wider added value to the Strategy for Collaborative Ageing Research in the UK.
- Estimate of costs (for information only, this is not part of the Letter of Intent assessment)

The deadline for the submission of Letters of Intent is **10 August 2011.**

Letters of Intent will be assessed on their fit to the call, and will not be assessed on their scientific quality. Full applications will be invited to the BBSRC Autumn Responsive Mode deadline of **4 October** and be assessed through its peer review committees.

Funding for this call is not ring-fenced and successful applications will be funded through BBSRC Responsive Mode funding, with co-funding with ESRC where there is an excellent social science component. The high strategic relevance of this area will be taken into account in the peer review process.

Town Meeting

A one day Town Meeting will be held on 5 July, in London, and open to the research community. The meeting will provide more detailed information and an opportunity for researchers to discuss ideas with the Research Councils, UK Sport and potential collaborators.