Annual Report 2012-2013
# Table of Contents

Annual Report 2012-13 .................................................................................................................. 2  
Mission Statement ......................................................................................................................... 2  
2012-13 Review .................................................................................................................................. 2  
People .............................................................................................................................................. 3  
Current Key Projects ......................................................................................................................... 9  
Our Outputs ...................................................................................................................................... 13  
  Stakeholder Reports .................................................................................................................... 13  
  Book Sections .......................................................................................................................... 13  
  Journal Articles ........................................................................................................................ 13  
  Invited Conference Presentations ............................................................................................. 14  
  Academic Conference Presentations ......................................................................................... 14  
  Stakeholder presentations ......................................................................................................... 15  
Knowledge Exchange & Public Engagement ................................................................................... 16  
Postgraduate training ...................................................................................................................... 17  
Our Plans for 2013-14 ...................................................................................................................... 17  
Our Partners ..................................................................................................................................... 19
Mission Statement
Our aim is to generate academically robust rugby science research with an applied focus that will improve player wellbeing and performance.

2012-13 Review
The 2012-13 season was a busy one for the RS@Bath group, including conference presentations, a number of original research articles published, some key projects completed, and some new and exciting research projects commenced.

The group has published a total of 10 full research articles in the current session in a variety of topics relating to the science and medicine of rugby. These articles have appeared in high-impact international journals and have covered a broad spectrum of research methodologies, from injury epidemiology, to lab-based studies, to field-based approaches. Some key projects were completed and reported on; these included the ‘CRISP’ project – a RFU funded injury surveillance study of community-level Men’s rugby in England which ran from 2008-2013, and the ‘Biomechanics of the Rugby Scrum’ project - an IRB-funded project which ran from 2010-2013 and has informed recent global changes to scurm laws in rugby union. Also in this year a number of new research projects have come on-stream, these include ‘CRISP2’ (2012-2015) funded by the RFU Injured Players Foundation, ‘RFU Catastrophic Injuries Database & Analysis’ (2012-2015) funded by the RFU, ‘Cervical Spine Injury Mechanisms in Rugby’ (2013-2014) funded by the RFU Injured Players Foundation, and ‘FMC: Rugby’ (2013-2016), an injury surveillance and performance monitoring study in youth rugby funded by the RFU Community, Education and Professional Rugby departments.

Along with various invited talks at rugby-related conferences, RS@Bath also had a large presence at the ECSS2013 Congress in Barcelona with a total of 11 oral presentations being delivered across a range of topics.

The core of the RS@Bath research group currently consists of 5 full-time members of academic staff, 2 external academics, 3 postdoctoral researchers on rugby-specific projects, 5 on-site postgraduates working towards PhD degrees, 1 external PhD student, and a part-time research technician. The group will be joined by a further full-time PhD student and full-time MPhil student in August 2013.

We would like to thank all clubs, organisations and individuals who have supported our work throughout the last year. In particular, we would like to thank those individuals who returned training and match exposure forms and injury forms. We would not be able to do any of this work without your efforts and we appreciate your hard work. Every single form is of great value to us.

Contact us via:  @RSatBath
## People

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Background</th>
<th>Current Position</th>
<th>Rugby Projects</th>
<th>Research Techniques / Other Relevant Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alex Atack</td>
<td><a href="mailto:Alexandra.Atack@smuc.ac.uk">Alexandra.Atack@smuc.ac.uk</a></td>
<td>BSc Sport &amp; Exercise Science</td>
<td>PhD student @ St Mary's University College</td>
<td>Biomechanics of rugby goal kicking</td>
<td>3D motion analysis</td>
</tr>
<tr>
<td>Neil Bezodis</td>
<td><a href="mailto:bezodisn@smuc.ac.uk">bezodisn@smuc.ac.uk</a></td>
<td>BSc Sport &amp; Exercise Science</td>
<td>Senior Lecturer in Biomechanics, St Mary’s University College</td>
<td>Biomechanics of rugby goal kicking</td>
<td>Experimental methods (biomechanics) Inverse dynamics modelling. Computer simulation of movement. Provided applied biomechanical support to UK Athletics, London Wasps, RFU.</td>
</tr>
<tr>
<td>Dario Cazzola</td>
<td><a href="mailto:d.cazzola@bath.ac.uk">d.cazzola@bath.ac.uk</a></td>
<td>Laurea degree (BSc+MSc) Biomedical Engineering.</td>
<td>Research Officer in Biomechanics.</td>
<td>Biomechanics of the rugby scrum.</td>
<td>Experimental methods (biomechanics/physiology). Biomech-related technologies (e.g. force, pressure, kinematics, IMU). Motion analysis (2D/3D – Vicon, BTS). Physiology-related tech (e.g. spirometry, oxygen consumption). Data processing and modelling (Matlab, Labview, Xcode, OpenSim).</td>
</tr>
<tr>
<td>Name</td>
<td>Email</td>
<td>Background</td>
<td>Current Position</td>
<td>Rugby Projects</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Christian Cook</td>
<td><a href="mailto:christian.cook@uksport.gov.uk">christian.cook@uksport.gov.uk</a></td>
<td>BSc Physiology, MSc Physiology, PhD in Paediatrics (“The development of neurophysiological function in the sheep fetus in utero”).</td>
<td>Honorary Research Fellow</td>
<td>Interactions between hormones and performance.</td>
<td></td>
</tr>
<tr>
<td>Sarah Churchill</td>
<td><a href="mailto:s.m.churchill@bath.ac.uk">s.m.churchill@bath.ac.uk</a></td>
<td>BSc Sport and Exercise Science with associated Biological Science, PhD in Biomechanics (“Biomechanical investigations of bend running technique in athletic sprint events”).</td>
<td>Teaching Fellow in Biomechanics. Other research interests: Sprinting technique, gait analysis.</td>
<td>Biomechanics of the rugby scrum.</td>
<td></td>
</tr>
</tbody>
</table>
| Matt Cross         | m.cross@bath.ac.uk              | BSc Sport and Exercise Science, MSc Sport and Exercise Medicine, Strength and Conditioning Coach | PhD in Injury Epidemiology                    | RFU Professional English Rugby Union Injury Surveillance Project, Pitch Side Concussion Assessment Tool (PSCA) Evaluation Project, Concussion Outcomes and Risk Project. | Description Epidemiology, Ex professional player.
<table>
<thead>
<tr>
<th><strong>Niki Gabb</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Background</strong></td>
</tr>
</tbody>
</table>
| BSc Physiotherapy (Oxford Brookes University)  
BSc PE & Sport Science (Loughborough University)  
Current Position: MPhil/PhD Student |
| **Rugby Projects:** |
| RFU Women's Rugby Premiership and England Injury and Training Surveillance Study |
| **Research Techniques/Other Info** |
| Descriptive Epidemiology  
Systematic Reviews  
Functional Movement Screening |
| n.gabb@bath.ac.uk |

<table>
<thead>
<tr>
<th><strong>Ed Gannon</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Background:</strong></td>
</tr>
</tbody>
</table>
| BSc Sport & Exercise Science  
Placement year at London Wasps RFC  
Current position – Part-time PhD student |
| **Rugby Projects:** |
| Strength & power development in rugby: Application of complex training |
| **Research Techniques / Other Relevant Info:** |
| Full-time fitness coach at Leicester Tigers RFC  
Physical performance testing  
Hormone analysis  
Study design in applied environments |
| ed.gannon@tigers.co.uk |

<table>
<thead>
<tr>
<th><strong>Polly McGuigan</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Background:</strong></td>
</tr>
</tbody>
</table>
| BSc Zoology (University of Bristol)  
PhD in Anatomy and Biomechanics “The scope for adjustment in compliance in the distal limb of the horse” (Royal Veterinary College, University of London).  
Current Position – Lecturer in Biomechanics.  
Other research interests: muscle-tendon interaction, muscle and tendon injury, healing and rehabilitation, trips/fall biomechanics, comparative biomechanics, objective assessment of gait and lameness. |
| **Rugby Projects:** |
| Motor unit recruitment patterns: risk factors for injury and consequences for training  
Muscle-tendon interaction during training exercises and functional activities |
| **Research Techniques / Other Relevant Info:** |
| In vivo measurement of muscle and tendon mechanics (ultrasound, EMG)  
Inverse dynamics modelling (Visual3D)  
In vitro muscle mechanics (many years ago!) |
| m.p.mcguigan@bath.ac.uk  
@pollymcguigan |
### Oly Perkin

**Background:**
BSc Sport and Exercise Science (University of Bath). Placement at Army Recruiting and Training Division, Occupational Medicine Research Department. Current position - Research Assistant

**Rugby Projects:**
Community Rugby Injury Surveillance Project

**Research Techniques / Other Relevant Info:**
Descriptive epidemiology
Functional movement screening

---

### Ezio Preatoni

**Background:**
Laurea degree (BSc+MSc) Biomedical Engineering. PhD in Bioengineering (“Innovative methods for the analysis of sports movements and for the longitudinal monitoring of individual motor skills”).

Current Position – Lecturer in Biomechanics and Motor Control. Other research interests: movement/coordination variability; skills learning/adaptation; biomechanics of (sports) movements; footwear biomechanics; health technologies; ergonomics.

**Rugby Projects:**
Biomechanics of the rugby scrum. Cervical Spine Injury Mechanism in Rugby (CeSIMeR)

**Research Techniques / Other Relevant Info:**
Experimental methods (biomechanics). Biomech-related technologies (e.g. force, pressure, kinematics, IMU). Motion analysis (2D/3D – Vicon, BTS). Data processing and modelling (Matlab, Labview).

---

### Simon Roberts

**Background:**
Bsc PE and Sports Science MSc Exercise Physiology PhD in Match demands of elite English rugby union and nutritional interventions for performance and recovery

Current position: Research Officer

**Rugby Projects:**
Injury surveillance - Community rugby injury surveillance project

**Research Techniques / Other Relevant Info:**
Time-motion analysis in rugby union
Functional movement screening
Descriptive epidemiology
**Gavin Shaddick**

**Background:**
PhD in Statistics and Epidemiology
Current Position: Reader in Statistics

**Rugby Projects:**
Community rugby injury surveillance project

**Keith Stokes**

**Background:**
BSc Geography and PE and Sports Science
PhD in Physiology (Human growth hormone responses to sprinting)
Current Position: Senior Lecturer in Physiology
Other research interests: ageing muscle; nutrition and performance

**Rugby Projects:**
Injury surveillance / risk factors for injury (youth, women’s, community, professional).
Biomechanics of the rugby scrum.
**Cervical Spine Injury Mechanism in Rugby (CeSIMeR)**
Physical demands of rugby union.

**Research Techniques / Other Relevant Info:**
Experimental methods and study design (physiology)
Descriptive epidemiology
Hormone measurement

**Grant Trewartha**

**Background:**
BSc Sport Science.
PhD in Biomechanics (“Marker-free tracking of human movement”).
Current Position – Senior Lecturer in Biomechanics.
Other research interests: trips/fall biomechanics, athletic sprinting technique, muscle-tendon mechanics, human balance control.

**Rugby Projects:**
Biomechanics of the rugby scrum.
**Cervical Spine Injury Mechanism in Rugby (CeSIMeR)**
Lower limb loading during evasive running.
Injury surveillance / risk factors for injury (youth, women’s, community, professional).
Injury mechanism analysis in rugby.
Technique analysis (e.g. line-out throwing, goal kicking).

**Research Techniques / Other Relevant Info:**
Experimental methods (biomechanics).
Inverse dynamics modelling.
Computer simulation of movement.
<table>
<thead>
<tr>
<th>Andonis Wallbaum</th>
<th>Sean Williams</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Background:</strong></td>
<td><strong>Background:</strong></td>
</tr>
<tr>
<td><strong>Rugby Projects:</strong></td>
<td>BSc Sport and Exercise Science (University of Bath).</td>
</tr>
<tr>
<td>Biomechanics of the rugby scrum.</td>
<td>Placement year spent at Sports Performance Research Institute of New Zealand.</td>
</tr>
<tr>
<td><strong>Research Techniques / Other Relevant Info:</strong></td>
<td><strong>Rugby Projects:</strong></td>
</tr>
<tr>
<td>Instrumentation</td>
<td>Investigating risk factors for injury in elite rugby through the application of frailty models.</td>
</tr>
<tr>
<td>Design and fabrication of test rigs</td>
<td>Allianz Park artificial surface evaluation.</td>
</tr>
<tr>
<td>Electronic processors</td>
<td><strong>Research Techniques / Other Relevant Info:</strong></td>
</tr>
<tr>
<td><a href="mailto:s.williams@bath.ac.uk">s.williams@bath.ac.uk</a></td>
<td>Statistical modelling.</td>
</tr>
<tr>
<td><a href="mailto:a.wallbaum@bath.ac.uk">a.wallbaum@bath.ac.uk</a></td>
<td>Meta-analyses.</td>
</tr>
<tr>
<td><a href="mailto:s.williams@bath.ac.uk">s.williams@bath.ac.uk</a></td>
<td>Descriptive epidemiology.</td>
</tr>
</tbody>
</table>

Descriptive epidemiology.
Current Key Projects

Biomechanics of the Rugby Scrum (2010-2013)
Funder: International Rugby Board

Aim: To provide the rugby community with objective data regarding the biomechanical demands of rugby scrummaging with a view to establishing safe scrummaging techniques.

Summary: Two phases of experimental trials (machine scrummaging then live scrummaging) collected on a game-wide basis from school age to senior international teams assessed the biomechanical loading imposed on front row players during different scrum engagement techniques. The second phase of the study investigated a pre-bind engagement technique which was shown to reduce the loading experienced by players during the initial engagement phase by approximately 20% whilst maintaining scrum stability and performance, and this technique is the basis for the global scrum law amendments for 2013-2014.

Title: The RFU English Professional Rugby Union Injury Surveillance Project
Funder: The Rugby Football Union

Aim: The aim of this study is to determine the incidence, types and causes of time-loss injuries and sustained by elite Premiership rugby union players in training and match play.

Summary: Match and training exposure for each club and data pertaining to injuries sustained during matches and training that resulted in more than 1 days absence is recorded by premiership club strength and conditioning staff and medical staff respectively. This data allows the identification of key factors such as injury type, causation and incidence in order to investigate risk factors for injury and to establish and best practice guidelines for injury management.

Title: A Perspective Investigation of Outcomes Following Concussive Injury in Elite Rugby Union
Funder: The Rugby Football Union

Aim: The aim of this study is to investigate concussion risk management in elite rugby union with reference to time course of symptom resolution and specificity of the PSCA for use within this playing population.

Summary: During the pre-season period of the 2012-2013 season players were asked to undertake a baseline test for a concussion management and assessment tools. Players that sustained a concussion during match play in the season underwent a PSCA at the time of injury and after-injury concussion tests that could be compared to those taken at baseline, while additional information on concussion history, return to play information and player performance statistics were used to investigate the use of the PSCA and changes in player performance pre- and post- concussive injury.
Risk of Injury Associated with Playing Elite Rugby Union on Artificial Turf

Funder: Rugby Football Union

Aim: To compare the incidence and nature of time-loss, non-time-loss and abrasion injuries between elite Rugby Union matches played on artificial turf and natural grass.

Summary: Saracens RFC are the first elite professional Rugby Union team to play matches on an artificial surface. Following an initial pilot study conducted during the 2012/13 season, surveillance will continue throughout the 2013/14 season in order to elucidate the role that playing surface has on injury risk in this population.

Previous Injury and Match Load as Risk Factors for Injury in Elite Rugby Union Players - Application of a Frailty Model for Recurrent Events

Funder: Rugby Football Union

Aim: This study aims to assess the role that previous injury and match loads may have upon injury risk in elite professional Rugby Union players, through the application of a frailty model for recurrent events.

Summary: Rugby Union injuries are often recurrent, with subsequent injuries influenced by previous occurrences and hence the correlation between events needs to be taken into account when analysing such data. The frailty model has been identified as the most appropriate statistical model for recurrent sports injury data, and so will be used to assess the role that a player's previous injury and match load has on current injury risk.


Funder: Rugby Football Union (Injured Players Foundation)

Aim: To understand the incidence and nature of match play injuries within English community rugby union and to explore player lifestyle, functional movement and physical fitness characteristics attributes as potential risk factors for injury.

Summary: The English community rugby population is one or the largest playing populations in the world, yet little is know about injuries at this level of rugby union. The first phase of the CRISP project involved gaining epidemiological data to understand more about match play injuries in community clubs of levels 3-9 with further work investigating the possible risk factors for injury such a lifestyle, functional movement and fitness characteristics.
Epidemiology of Match Injuries in Elite English Women’s Rugby Union

Funder: Rugby Football Union

Aim: To describe the incidence, type and severity of injuries sustained by elite Women’s Rugby Players

Summary: Over 200,000 women are currently playing rugby in over 100 countries (IRB 2011), despite this, relatively little evidence exists from the women’s game as to the incidence’s, causes or severity of injuries incurred during both match play and practice. This study sees the establishment of an annual Injury Surveillance study in women’s rugby union and thus provides the platform from which to describe the size of the injury problem to this specific population.

Injury Surveillance Study of an International 7s Squad: A Case study

Funder: Rugby Football Union

Aim: To describe the incidence, type and severity of injuries sustained by an International Women’s World Cup Seven’s Squad.

Summary: Despite the popularity worldwide of women’s rugby sevens there is relatively little published literature regarding injury risk associated with Rugby Sevens and no previously published information regarding the injury risk in women’s rugby sevens. This surveillance study will follow an International women’s sevens squad across a six month period in the build up to the IRB World Cup.

Cervical Spine Injury Mechanism in Rugby (CeSiMeR) - (2013-2014)

Funder: Rugby Football Union Injured Players Foundation

Aim: To investigate the mechanisms of cervical spine injury during rugby specific events, with a view to generating an initial dataset from which to exploit future research opportunities in the field of spinal-injury biomechanics in sports.

Summary: The precise mechanisms of cervical spine injury are not still well elucidated, and a multiscaled and multidisciplinary method will provide a comprehensive understanding of cervical spine injury mechanism during rugby scrumming and tackles. Such multi-scale research will include both experimental and modelling research techniques for the estimation of internal and external stresses acting on the cervical spine, and the assessment of injuries thresholds.
FMC: Rugby - Using functional movement control principles to reduce injury and enhance performance in youth rugby players (2013-2016)

Funder: Rugby Football Union

Aim: To evaluate whether integrating the principles of functional movement control as part of the warm-up and training programmes of youth rugby players can enhance performance metrics and reduce the risk of injury.

Summary: A 3-season study (2013/14-2015/16) will investigate the role that functional movement control has on injury risk and performance potential in youth rugby players. The project will develop normative values of physical, psychosocial and functional movement characteristics of school-age rugby players and will assess whether exercise interventions to improve functional movement can reduce injury risk and improve physical performance.
Our Outputs

Stakeholder Reports


Book Sections


Journal Articles


**Invited Conference Presentations**


**Academic Conference Presentations**


Stakeholder presentations


Knowledge Exchange & Public Engagement

IRB Rugby Science Network

http://www.irbsciencenetwork.com/

In November 2012, IRB Rugby Science Network was launched. Grant Trewartha and Keith Stokes are co-founders and network editors along with Stephen Mellalieu (Swansea University). As of June 2013 the network has over 500 active members and nearly 2000 followers on Twitter.

The IRB Rugby Science Network is a global network of researchers who are interested in the study of the Rugby Football codes. The aim is to provide a forum which brings together the expertise of academics and professionals working in the Game. By sharing good Rugby science practice and discussing future directions, we can enhance the scientific study of the Game and work to ensure that Rugby science becomes Rugby practice where possible.

The aim of this network is to:

1. Promote the scientific study of the game and the transfer of scientific knowledge into professional practice through international collaboration.
2. Provide an international forum for the interaction between people interested in the science and practice of Rugby Football.
3. Work towards the establishment of a periodical conference and publication for academics and practitioners interested in Rugby Football.

Media

BBC Radio Wales interview with Grant Trewartha (January 2013) focussing on extent of injuries in elite rugby union prior to RBS 6Nations 2013.


Visitors to the University

In June we hosted Dr Sharief Hendricks from the University of Cape Town for a short visit to the University. The purpose of his visit was to discuss avenues for injury prevention in rugby.
Postgraduate training

Ed Gannon (part-time PhD student) successfully completed the MPhil to PhD transfer process for his research to date on a thesis entitled ‘Acute and long-term effects of post-activation potential strategies for strength and power development in the applied sport setting’.

Jo Larkin (MSc Sport & Exercise Medicine) completed a dissertation entitled ‘England Women’s Rugby Football Union Injury Audit: The incidence and characteristics of rugby injuries in Elite RFU female players during one rugby season (2011/2)’.

Francesca Martin (MSc Sport & Exercise Medicine) completed a dissertation entitled ‘The Management Of Suspected Concussion in Community Rugby Union’.

Becky Davison (MSc Sport Physiotherapy) completed a dissertation entitled ‘The Effect of Fatigue on Shoulder Joint Position Sense (JPS) in the Tackle Position for Rugby Players’.

Our Plans for 2013-14

Out in the Rugby Community: As part of our existing and new injury surveillance/prevention projects with the RFU at Community, Women and Youth levels, our team will be spending a considerable amount of time in the coming year travelling to rugby clubs to put players through a variety of physical screening tests to accompany the injury surveillance data already being collected – all designed to help establish which factors are associated with injury in each of these rugby populations.

Fostering international links: The RS@Bath group will continue to engage with the IRB Rugby Science Network as Network Editors, Section Editors, and via contributions to the discussion forums. RS@Bath will also continue to foster our relationship with the Exercise Science and Sports Medicine research group at the University of Cape Town in South Africa. Our respective groups have many shared interests and projects in relation to injury prevention in rugby union and we shared some healthy exchanges of ideas and information around rugby science and medicine in 2012/13 via virtual meetings and face-to-face visits, and we look forward to more of the same in 2013/14.

Web exposure: RS@Bath will be looking to enhance our web presence in 2013/14, primarily with the aim of disseminating information and exchanging knowledge from our research projects that should be of interest to the rugby community.

Social Media: @RSatBath has recently been established as our group’s twitter tag and we are aiming to make sure that this twitter account gets active and provides interesting and important chunk-sized gems of rugby science information out into the wider world at regular intervals.

IOC congress: From a formal scientific dissemination perspective, our group’s main focus for 2013/14 will be to submit and present a number of key studies to the IOC World Conference on Prevention of Injury and Illness in Sport in April 2014.
**Publishing research:** The RS@Bath group continue to disseminate our original research through traditional peer-reviewed scientific outlets. Our group has a healthy number of research articles already in the review cycle and close to submission. These articles are mainly in the topic of injury epidemiology in relation to Community rugby and the scrum, the biomechanics of scrummaging, power development in rugby union, and longitudinal risk factor analysis for injury in elite rugby players.

A selection of our research articles that have or are about to enter the peer review cycle include:

Roberts SP, Trewartha G, England M, Shaddick G & Stokes KA. Epidemiology of time-loss injuries in English community level rugby union.

Taylor A, Kemp SPT, Trewartha G & Stokes KA. Scrum injury risk in professional rugby union.

Cazzola D, Trewartha G & Preatoni E. Time-based calibrations of pressure sensors improve the estimation of force signals containing impulsive events.

Roberts SP, Trewartha G, England M & Stokes KA. Propensity of contact events to cause injury in community rugby union: a focus on collapsed scrums and collision tackles.

Palmer-Green DS, Stokes KA, Fuller C, England M, Kemp SPT & Trewartha G. Training injuries in English youth academy and schools rugby union.

Preatoni E, Stokes KA, England M & Trewartha G. Engagement techniques and playing level impact the biomechanical demands on rugby forwards during machine-based scrummaging.


Our Partners

[Logos of various rugby organizations]