Human Performance in Hypoxia Inducing Environments: Natural and Simulated Altitude
A BASES expert statement
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BASES Annual Report Available
The Board has pleasure in presenting its annual report and the financial statements of BASES for the year ended 31 March 2011. Available: www.bases.org.uk/Publications-Documents-and-Policies

Newly Elected Officers for 2011-2012
Prof. Ian Campbell, Brunel University (shown left), is the new Chair-Elect and will succeed Prof. Jo Doust FBases as Chair in September 2012 for a period of three years.

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BASES Conference 2012
BASES Conference 2012 will be integrated into ICSEMIS 2012
International Convention on Science, Education & Medicine in Sport
Scottish Exhibition & Conference Centre, Glasgow, UK
19 - 24 July 2012
March 2012 - Early Bird Registration Deadline
www.icsemis2012.com
BASES Conference 2011

The BASES Conference 2011 was hosted at the University Essex in Colchester and was entitled “Fatigue: An Interdisciplinary Approach”. Highlights of the conference included keynote presentations by Profs Scott Powers (University of Florida), Roger Enoka (University of Colorado), Jack Raglin (Indiana University), Leslie Findlay (Essex Neurosciences Unit) and Alison McConnell FBASES (Brunel University). There was also a highly topical keynote symposium on Olympic legacy from Dr Ken van Someren FBASES (EIS), Dr John Buckley FBASES (University of Chester) and Gareth Smith (Podium). Special thanks is extended to all of the 330 delegates, presenters, exhibitors and other contributors who made BASES Conference 2011 an enjoyable and successful event.

Award Winners
Elsevier Student Oral Presentation Award - Jamie Highton, University of Chester
Human Kinetics Student Poster Presentation Award - Jennie White, University of Portsmouth
Sportesse Sport Science Oral Presentation Award - Dr Paul Castle, University of Portsmouth
Sportesse Exercise Science Oral Presentation Award - Dr Costas Karageorghis, Brunel University
Routledge Recently Qualified Researcher Early Presentation Award - Kevin Deighton, Loughborough University
University of Essex Poster Presentation Award - Andy Galbraith, University of Kent


Have I got SES news for you…

As sport and exercise science becomes more prominent in the media, Dr Melissa Day’s new column aims to focus on media appearances and gain expert perspectives on issues highlighted in the press.

The current impact of sport in the media is clearly evident, not only through the coverage of major events but also with an increasing media interest in expert opinions, research findings, applied practice, and the science behind sports performance. In this new column I aim to focus on sport and exercise science in the news and the media. We start by demonstrating one example of applied practice where expert opinions were sought in order to explain sports performance.

In September, Sky Sports sought to answer the question: ‘What makes Ronaldo so good?’ To answer this, a series of physical, technical and psychological tests were set up to test his abilities. Biomechanist Dr Neal Smith (University of Chichester) was one of a team of experts asked to test Ronaldo’s abilities. One such example included a free-kick test, during which Neal explains “a series of 47 reflective markers were placed over key anatomical landmarks of Ronaldo’s body to reconstruct his free-kick techniques. A specialist Vicon motion capture system was used, with 10 infra-red cameras operating at 500 images per second to track each of the body markers. Vicon then reconstructed a series of Ronaldo’s curved and dipping free kicks and generated a computer animation of his skeleton, from which we could measure joint angles, angular velocities, and gain an indication of the ratio of foot to ball velocities.” Neal commented, “This was a fantastic opportunity to work with one of the world’s elite footballers. The time demands of filming on location and the integration of cutting edge biomechanical techniques provided a unique challenge to my applied skills.”

The end result of the programme meant that Neal was able to identify differences in foot trajectory and impact characteristics when Ronaldo performed his knuckleball free kicks. This programme, Ronaldo – Tested to the Limit can still be seen on Sky Anytime or on YouTube.

What to feature in this column? Contact Dr Melissa Day m.day@chi.ac.uk

From the Chair

Prof Jo Doust FBASES

Internships: Enhancement or exploitation

The growing number of internship opportunities for sports science graduates seem to offer a fine way of gaining experience and helping launch a career. But as a profession are we simply exploiting young people’s labour and ambition? I remember many years ago a now eminent sports psychologist reasoning why he always charged for his services: If you do not charge you are not valued, and every time he gives something away for free he is diminishing the chance of his profession becoming properly established and diminishing the future for his colleagues and students.

For certain, some parts of sport rely on volunteers. But professional sport, exercise businesses, universities and public bodies do not. To what extent should these “professional” organisations lessen normal legal and ethical guidelines on pay, conditions and contracts in return for accepting the lesser experience and skill level of young people and helping them to gain valuable workplace skills?

For several years the UK Sport internship programme seemed to provide a fair balance. It aimed to accelerate the professional development of young practitioners with a package worth over £20,000 inclusive of salary, personal development allowance, developmental workshops and a workplace mentor. What about a private school offering tennis coaching internships to develop players from age 13-18, through squads and individual lessons on a stipend of £5,700 per annum plus full board plus opportunities for professional development such as the LTA Coaching Apprenticeship Scheme? Or a commercial manufacturer offering a 6-week programme for graduate sports scientists, working on professional rugby camps, which required daily presentations on the product to junior rugby players and coaches at the camps, educating players about sports nutrition, promoting the products, and producing weekly blogs? The package in recompense - travel and food expenses. Fair exchange for the opportunity to gain experience or exploitation of sports science graduates?

In this issue, Helen Weavers from Dundee describes how her University has attempted to balance opportunity with support, progression and reward through an appealing internal university internship programme. Should BASES develop some guidelines and good practice? Opinions welcome.
Background and evidence

Over 35 million people travel to high altitudes (>3,000m) each year with a greater number travelling to moderate altitude (1,500m - 3,000m) including elite athletes undertaking training or competition (Wilber, 2004). Altitude (i.e., hypobaric hypoxia; HH) results in arterial hypoxemia (low blood oxygen) due to a reduced barometric pressure and an unchanged fraction of inspired oxygen (FiO2; ca. 21%). Simulated altitude (i.e., normobaric hypoxia; NH) results in arterial hypoxemia due to a reduced FiO2 with an unchanged barometric pressure. Commercially available NH environments, such as altitude chambers and altitude tents, control FiO2 via nitrogen dilution where nitrogen is added to ambient air reducing the FiO2. It is generally accepted that the physiological response to HH is the same as NH at moderate altitude, however; there are few empirical data to support this hypothesis. There may be differences in responses at high (3,000m - 5,400m) and extreme (>5,400m) altitude particularly associated with the incidence of high altitude pulmonary oedema (HAPE) and high altitude cerebral oedema (HACE; West et al., 2007).

Exercise capacity diminishes with ascent to altitude, associated with a reduced arterial oxygen pressure (PaO2) evident in a haemoglobin desaturation (SaO2). Hypoxia Inducible Factor 1 alpha (HIF1-α), is stabilised in hypoxia signalling a downstream cascade of responses, including erythropoiesis, angiogenesis and metabolic reprogramming (Semenza, 2009). These adaptations improve hypoxia tolerance and may enhance sea level endurance performance in some individuals. Limited data exist demonstrating positive adaptations to strength, power and anaerobic capacity as a result of a hypoxic intervention.

A number of deleterious effects result from a reduced PaO2 including Acute Mountain Sickness (AMS) characterised by a spectrum of maladaptive responses from minor (i.e., headaches, sleep disturbance, anorexia, sunburn and dehydration) to the potentially fatal HAPE and HACE, usually at higher altitudes (West et al., 2007).

Altitude training

Common altitude training practices amongst athletes include: living and training high (LTH); living high and training low (LHTL) in order to maintain training intensity; living low and training high (LLTH); and intermittent hypoxic training at rest (IHT; Wilber, 2004; see Table 1). These paradigms can be achieved with natural altitude, simulated altitude, or a combination.

Pre-ascent evaluation

Pre-ascent evaluation should include iron status, primarily ferritin although a comprehensive screen would include other measures such as transferrin receptor (Suominen et al., 1998) and total haemoglobin mass measured by carbon monoxide rebreathing (Schmidt & Prommer, 2010). Exercise responses in NH (lactate, heart rate and oxygen saturation via pulse oximetry) can identify those athletes who are likely to cope well at altitude. Those with the greatest decline in performance and peripheral oxygen saturation during heavy exercise in acute hypoxia are most likely to suffer losses in performance at altitude. This knowledge may be particularly useful for those travelling to high altitude.

Acclimation and acclimatisation

Simulated altitude facilities are useful for acclimating individuals prior to ascent, either through exercise or sleep. In athletes, the duration of time exposed to NH is crucial in the use of sleeping devices with a critical duration of at least 12 hours/day. Some protection from AMS is possible with shorter duration exposures. Limited evidence exists for the use of IHT for acclimatisation or performance enhancement (Levine & Stray-Gundersen, 2006). Short term acclimatisation (primarily ventilatory) occurs over 5-7 days at moderate altitude, although adaptations will continue to occur over a number of months. To ensure an adequate erythropoietic response to altitude, at least 3 and preferably 4 weeks of exposure is recommended. Iron status assessments should be repeated at altitude to ensure they remain unchanged.

Management of training volume

Exercise responses are disrupted at moderate altitude such that a leftward shift in the lactate curve and raised heart rate are observed, gradually returning to baseline (sea level) values with acclimatisation. To avoid over-reaching, athletes must reduce training intensity during the initial 7-10 days at altitude. Other factors must also be considered, for example, extended journey time to reach altitude training venues resulting in fatigue.

### Table 1. Altitude training approaches

<table>
<thead>
<tr>
<th>Altitude training approach</th>
<th>Advantage</th>
<th>Disadvantage</th>
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<tbody>
<tr>
<td>LHTL using natural altitude</td>
<td>Potential for a greater HIF1-α cascade</td>
<td>Requirement to descend for high intensity training</td>
</tr>
<tr>
<td>LHTL using supplemental oxygen</td>
<td>Remain in one training venue</td>
<td>Practicability of training with oxygen cylinder only suits some sports</td>
</tr>
<tr>
<td>LHTL using hypoxic tent</td>
<td>Remain in home training venue, year round</td>
<td>Difficult to accumulate enough hours in the tent (&gt;12 hours recommended)</td>
</tr>
<tr>
<td>LLTH using normobaric hypoxia</td>
<td>Potential for enhanced training quality</td>
<td>Duration of exposure insufficient for acclimatisation.</td>
</tr>
<tr>
<td>LTH</td>
<td>Maximised opportunity for HIF1-α expression</td>
<td>Potential loss of training quality due to reduced oxygen flux in high intensity training sessions</td>
</tr>
<tr>
<td>IHT at rest</td>
<td>Limited evidence of efficacy</td>
<td></td>
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</tbody>
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Biomechanics
Fast, sprint speeds are experienced and this may be a desirable feature of training at moderate altitude for anaerobic individuals. The trajectory of projectile objects will be affected by HH and the athlete will need to adjust their technique in order to compensate for this, adjusting it again upon return to sea level (Chapman et al., 2010). Furthermore, athletes who time their inspiration and expiration according to their stroke, e.g., swimmers, canoeists and rowers, will have to adjust their timing at altitude because of a relative hyperventilation.

Sleep
Some athletes (25-35%) will experience sleep disruption caused by periodic breathing resulting from the interplay between hypocapnia and hypoxia leading to central sleep apnoea. This improves or disappears with acclimatisation. Global sleep quality can be monitored using actigraphy, sleep questionnaires and other sleep monitoring devices. However, to identify periodic breathing and sleep architecture, more intensive monitoring tools can be employed (i.e., polysomnography; Pedlar et al., 2005). At moderate altitude sleep should improve over 2-3 nights, although, profound sleep disruption may be experienced at high altitude, which may not improve with acclimatisation depending on the altitude and the individual.

Acute mountain sickness
Some athletes at moderate altitude may experience symptoms of mild AMS (i.e., headache and nausea), but this is rare and generally self-limited. Although this can impact upon training during the first few days at altitude, it is rare for symptoms to be sustained or get worse while remaining at the same moderate altitude. At high altitude AMS is common and exacerbated by exertion. Paradoxically, gains in aerobic capacity prior to ascent fail to offer protection from AMS. Symptoms may include headache, nausea/vomiting, fatigue/malaise, dizziness and sleep problems or insomnia. These can be assessed using the Lake Louise Questionnaire. Secondary to AMS are the more severe conditions of HACE and HAPE, which are both potentially life threatening and these should be referred directly to a doctor (West et al., 2007). Individuals travelling to high altitude without a doctor present should learn the signs of AMS, which are described extensively elsewhere (Imray et al., 2010), in order to self-diagnose and treat accordingly. Treatment is rapid descent, however prophylactic administration of Dexamethasone (banned substances for athletes) are effective, when taken 24–48 hours prior to ascent. This applies to individuals going to high altitude (>3,000m).

Other issues
Dehydration is common at altitude, caused by sweating and fluid loss through the upper airways due to increased ventilation. The atmosphere offers less protection from UV radiation, thus sunburn occurs more rapidly than at sea level. Weight loss has been observed at altitude, which may be caused by a loss of appetite, or a change in energy balance (either because of changes to energy expenditure or food availability).

Performance post-altitude
The optimum time to descend prior to competition is poorly understood. Studies suggest high quality performance is sustained at sea level for 3-4 weeks. LHTL athletes may have substantial improvements even in the first few days after return, however this may be more variable. It is known that upon removal of the hypoxic stimulus, a reversal of some altitude-specific adaptations occur rapidly (i.e., neocytolysis, red blood cell destruction), and the entire acclimatisation response is mostly undetectable after 4 weeks at sea level. Acid/base balance is acutely affected by the return to sea level with potentially negative performance implications. At altitude, respiratory alkalosis results in a loss of bicarbonate, which must be restored in order to effectively buffer acidosis during high intensity exercise. This is somewhat variable between individuals but may take up to a week to fully restore.

Conclusions and recommendations
• Altitude training offers a natural method of potentially enhancing performance.
• Individuals should be assessed and educated on the effects of altitude before travelling.
• Pre-acclimatisation is recommended prior to travel to moderate and high altitude to reduce training disruption in athletes and AMS in climbers.
• Disrupted training and recovery are expected at altitude, requiring careful management.
• At high altitude, AMS is common, potentially worsening to HAPE or HACE, all of which should be assessed and treated by a doctor. If no doctor is present, individuals travelling to high altitude should be educated in the signs, symptoms and treatment of AMS.
• Other problems such as sunburn and dehydration should be avoided.

References

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The Whyte answer!

Conference madness!

“Austerity” and “Conference” - two words that should rarely be used in the same sentence and yet, there appears to be an ever growing number of national and international conferences alongside a funding stream with a downward trajectory. Gone are the days where we were all drawn to a small number of mega-conferences organised by national and international organisations; now we are bombarded by an overwhelming array of specialist, sub-specialist, discipline and sub-discipline conferences, workshops and education days.

Accelerating the exponential growth in conferences is the rapid appearance of the London 2012 Olympics and Paralympics (yes there is a Paralympic Games as well!) on the horizon, which has resulted in mass panic in the UK conference market as national organisations, professional bodies and special interest groups scramble to be aligned in somevicarious way to the magic of the rings. Even those organisations that struggle to spell “sport” and “exercise” are mounting the Olympic hobby horse in the hope of a ride that will provide some form of reflected glory. Whilst the plethora of “meetings” (an American term that somehow better encapsulates the essence of the contemporary conference scene) may at first sight appear a good thing, there are however a number of issues for the would-be delegate. Whilst surveying the available mass of conferences one question pervades: What makes a good conference? The answer to this question has become more important in recent years as we have welcomed our good friend “Austerity”. For most academics and practitioners the first budget to be cut is that of continued professional development (don’t believe what they tell you; you’re not indispensible!) Accordingly, choosing the right conference is critical as it is likely to be your only conference!

So what makes a good conference? As chair of the scientific committee for the International Convention on Science, Education and Medicine in Sport (ICSEMIS) 2012 (the conference that boasts the inclusion of the BASES Conference 2012) I have spent much time pondering the answer to this question. I have developed the “3 Ls-theory”: Location; Line-up; and Leisure.

To the final of my 3 Ls: Leisure. Great conferences are defined by the extra-curricular activity programme which, in addition to location, is determined by a number of factors; most importantly of which is variety and diversity. Providing opportunities for delegates to: meet old friends and make new friends; provide space and time for networking and socialising; and, experience local cultures and activities outside of the conference environment. These all provide for an academic and personal enrichment.

Make sure that your chosen conference fulfils your personal and budget expectations; it’s not a holiday but it certainly shouldn’t be a short stay at her majesty’s pleasure! Check out the line-up; if you’ve seen the headliners in the past two years and they’re offering-up the same title then expect the same slides and take a pillow! And finally, too much work makes Jon/Jane a dull man/woman, so check-out the activities outside of the conference environment. These all provide for the seemingly “in-bred” presenter family, and that does not mean another member of the consanguineous boys club (or indeed women’s club, although there always appears to be a testosterone, western European bias to conference line-ups). A good conference is defined by the disappointment of missing outstanding sessions because of concomitant excellence running throughout the programme.

Now to the Line-up: A worrying trend in the expansion of the conference market are the ever-present “world leaders” who seem to be constantly on the road, riding the conference merry-go-round without ever getting off to undertake contemporary research or even up-date their slides! Research simply doesn’t move at a pace that requires the annual appearance of the same old faces in the same old format; move over and allow some new blood into the seemingly “in-bred” presenter family, and that does not mean another member of the consanguineous boys club (or indeed women’s club, although there always appears to be a testosterone, western European bias to conference line-ups). A good conference is defined by the disappointment of missing outstanding sessions because of concomitant excellence running throughout the programme.

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Why was the Booster trial needed?
Most British adults do not achieve the recommended levels of physical activity (The NHS Information Centre, Lifestyle Statistics, 2010). A wide range of brief interventions has been developed that enables sedentary people to increase their activity levels. The interventions may be delivered in a variety of settings, e.g., at a GP surgery or in the community, and in a range of formats, such as in person, in print or online. Some are individually tailored, while others are more widely targeted towards the general population. The National Institute of Health and Clinical Excellence recommend the use of brief interventions in Primary Care to promote physical activity (NICE, 2006).

It is well-known that many new exercisers relapse and return to their sedentary lifestyle within six months of becoming more active. There remains little evidence about whether providing these people with further support can help them maintain long-term physical activity. The Booster trial was designed in response to a commissioned call by the National Institute of Health Research’s Health Technology Assessment Programme to address this issue. It will investigate whether the provision of additional “Booster” interventions after the initial intervention can help people maintain their newly active lifestyle in the long term.

What are the Booster interventions?
The Sheffield physical activity “Booster” trial is a large research study assessing different approaches to helping people who have recently become physically active to stay active. Booster began in 2009 and aims to recruit 600 participants. Recruitment is expected to close in November 2011, with data collection continuing into 2012. Booster is a three-arm randomised controlled trial investigating whether physical activity is significantly increased in participants allocated to receive one of two Booster interventions compared to participants allocated to the comparison group.

Previously sedentary individuals who have recently become physically active as a result of receiving a brief intervention from the local Primary Care Trust (PCT) are being invited to take part. Those who agree are randomly allocated to one of three groups:

- **Group 1** receive two face-to-face physical activity consultations using Motivational Interviewing (MI) techniques.
- **Group 2** receive the same two MI-based consultations, but delivered via the telephone.
- **Group 3** are the comparison group that receive no consultations or support.

Dr Emma Scott*, the Trial Manager, discusses some of the reasons for the biggest challenge - recruitment - and how it is being managed.

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Dr Emma Scott is the Booster Trial Manager and a Research Fellow in the School for Health & Related Research at the University of Sheffield. Full details of the intervention and trial protocol have been published in the open access journal BMC Public Health (Hind et al., 2010).

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What is Motivational Interviewing (MI)?
MI is a directive, client-centred counselling style for eliciting behaviour change by helping clients explore and resolve ambivalence (Rollnick & Miller, 1995). The content of the consultations is based on the Trans-Theoretical Model of behaviour change (Prochaska & DiClemente, 1983) and uses six strategies appropriate to people in the maintenance stage of change:
1. Assessment of motivation and confidence to maintain physical activity
2. Awareness raising: Benefits of physical activity, risks of a sedentary lifestyle, local physical activity opportunities, current physical activity recommendations
3. Increasing confidence to be physically active (self-efficacy)
4. Goal setting and tracking using SMART principles
5. Strategies to stay motivated
The consultations last 20-30 minutes and are delivered one and two-months after joining the trial. The face-to-face consultations take place in community venues spread across the City.

What has been the main issue faced by the Booster team?
Participant recruitment - The aim of recruiting 600 participants over 18 months seemed like a realistic target. Two years on and 600 participants is still a long way off (recruitment = 246 on 6 October 2011). There have been various reasons for this:

1. Maintaining contact with potential participants: To be eligible for Booster, people must have increased their physical activity level as a result of the brief intervention from the PCT. Over the last two years, almost 2,000 people have received the initial brief intervention, which should provide a big enough pool of potential participants for Booster. Re-contacting people has not been easy. When they initially signed up for the brief intervention, people were encouraged to provide e-mail addresses, home and mobile phone numbers, in addition to their postal address. Three months later, only about half have been contactable using the details provided. All methods of contact available have been tried and in the case of phone numbers, at least three attempts have been made.

Although delivered at an individual level, the brief intervention was targeted at the areas of Sheffield identified by the PCT as suffering from significant health inequalities. As the intervention was self-guided, there was no need for continued contact after the initial sign up and we have since discovered that many of these communities have highly transient populations.

Being unable to contact such a large number of potential participants has certainly had a negative impact on recruitment and the repeated attempts to make contact has consumed a lot of staff time. This was a completely unforeseen problem and unfortunately, at this stage in the trial, there is not much that can be done to address it aside from offering the brief intervention in other, hopefully more stable communities. We have worked with the PCT to do this and wait to see whether it will successfully increase our pool of contactable potential participants.

2. Refusal to participate: On the positive side, the brief intervention appears to have been successful; about 500 of the 1,000 people we successfully re-contacted have become more active making them eligible for Booster. Recruitment of these individuals has, however, been much lower than expected.

Not everyone who is eligible for a trial will agree to take part. Refusal is usually due to the perceived time commitment, an unwillingness to be randomly allocated to an intervention, or because they are just not interested. In the case of Booster, however, the main reason appears to be that the people who have successfully become more active do not believe they need extra support to stay active.

Despite the evidence showing that most people do need additional support, if people believe that they don’t, it can be very hard to change that belief without making them feel like they are doomed to failure. We have re-written the recruitment and study information materials to emphasise the benefits of further support more strongly, but this appears to have had little effect. We have also explored using testimonials from participants who have already received the Booster interventions, but this has met with numerous regulatory barriers as it was deemed to be coercive.

3. No shows: Many studies experience problems with people saying that they are interested in taking part, booking an appointment and then not attending. Booster has had a much larger than expected rate of no-shows, up to 50% for initial visits. The main reason given is that people simply forgot about the appointment.

We have always offered appointments at varying times, days and venues to maximise participant convenience and we have now introduced various ways to reduce the number of forgotten appointments. Confirmation letters including time, date and venue, are sent for all appointments at the time of booking. These letters also include maps and travel information, if required, and contact details for both the Booster office and the team member they will be meeting in case of any problems. We have also introduced reminder texts/phone calls the day before the appointment, again with contact details in case participants need to reschedule. These approaches have had little impact on the number of no-shows and further ideas are constantly being considered. It is interesting to note that many no-shows do re-book their appointment and attend the second time, confirming their interest in taking part and reinforcing the fact that they genuinely forgot about the original appointment.

What has been the biggest lesson learned?
You can’t anticipate all of the problems you will face in recruiting participants to a study. We were aware that not everyone receiving the brief intervention from the PCT would become more active and that not all of those who became active would agree to take part in Booster. These issues were factored into the initial recruitment projections. The three problems discussed above were, however, a complete surprise. The most important thing is to remain flexible in your approach to recruitment and if it is slower than anticipated investigate why, rather than hoping it will improve.

*On behalf of the Booster research team Goyder, E., Copeland, R.J., Breckon, J.D., Hind, D., Crank, H., Munyaradzi, D., Humphreys, L., Wood, R., Kesterton, S., Horspool, K., Hutchinsson, A., Swaile, P.B. & Walters, S.J.

Acknowledgements
The Sheffield Physical Activity “Booster” Trial is funded by the National Institute of Health Research Health Technology Assessment Programme (HTA 0725/02) and will be published in full in the Health Technology Assessment journal series. Visit the HTA programme website for more details (www.hta.ac.uk). The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the Department of Health. Booster is a collaboration between the University of Sheffield, Sheffield Hallam University, NHS Sheffield (PCT) and Sheffield City Council.

References


Synchronised Swimming - The importance of understanding your client

Rachel Sheldrick shares her experience of quantifying and comparing the intensities of competition and training routines using metabolic markers, for British Swimming’s Synchronised Swimming Team at their recent European Championships.

Introduction

Synchronised swimming is a team sport requiring high levels of strength and flexibility combined with rhythmic flare. There are four events - the duet, solo, team and combination. The Great Britain Performance Director requested a physiologist to conduct blood lactate testing to assess how the duet routine’s intensity in training compared to that in competition.

Baseline testing 1 and 2

Being new to synchronised swimming, I first had to understand the physiological demands of the performance and the learning style of the National Performance Director, who was also the lead coach and my client. This understanding was needed to be able to feedback the testing results in the right context and in a form that the Performance Director would be able to use. Having only two 3-hour baseline testing sessions before the European Championships achieved this quickly.

During my first testing session I was able to discuss the project with the Performance Director. I was very conscious of making a good impression and trying to understand the expectations of my delivery during this project. Observing my new environment allowed me to form a good relationship with the Performance Director I had entered competition feeling confident that I understood my client and had a good understanding of her expectations of me and of her learning style and behaviour, whereas in the competition environment I was able to concentrate purely on the technical skills of testing the athletes. This distinction in emphasis between technical and non-technical skills was very important, as securing a good relationship early on was essential with such limited interactions with the client.

A key example of this was when I fed back the results from the first baseline testing. Every comment I made was questioned by the Performance Director. I initially perceived this to be critical; however, on reflection, I soon realised that this was not the case. The Performance Director’s learning style dictated that if she challenged an action or decision, it deserved consideration if a valid rationale could be provided.

Additionally, initial baseline testing only gave a small indication of the athletes’ physiology, limiting my feedback to the Performance Director. Giving feedback on a single testing session in the field is hard as you only have an indication of where the client(s) are at that point in time, especially as in this example capillary blood lactates were the only measurements taken. There are also many variables that can influence blood lactate data, which are difficult to control in the field setting. No matter how many variables you measure during a training session, one cannot definitively understand how a client’s previous training has impacted on the testing results, or what the future training implications from the testing may be from a single session. These factors did not help when trying to explain the data to the Performance Director.

In hindsight I should have established clear expectations of what could be concluded from the data with the Performance Director before the first baseline testing. Discussing and agreeing realistic expectations of what can be concluded from the data is important for when data are being fed back to the client. Having learned so much from reflecting on my first experience synchronised swimming, the second baseline testing went very smoothly. I modified my behaviour to provide a strong scientific rationale for all decisions and feedback given.

Competition

Whilst the competition component was perceived as the most important part of my role during my support to Synchronised Swimming, it was the time I felt most at ease having done all the hard work during the baseline testing sessions. Having already formed a good relationship with the Performance Director I entered competition feeling confident that I understood my client and had a good understanding of her expectations of me and of the sporting demands. Reflecting on this I realised my emphasis had changed between baseline and competition. During baseline I focused all my efforts on the non-technical skills of understanding my client, her learning style and behaviour; whereas in the competition environment I was able to concentrate purely on the technical skills of testing the athletes. This distinction in emphasis between technical and non-technical skills was very important, as securing a good relationship early on was essential with such limited interactions with the client.

In the majority of situations I have experienced, understanding your client and adapting to their needs is vital, regardless of whether the scientific intervention is very basic or advanced. Without this understanding you cannot fully engage your client in your intervention and completely meet their needs.

Understanding my client also meant understanding how the Performance Director viewed my role. I was conscious of the importance of the European Cup, so I discussed with the Performance Director her expectations of me during competition.
“During baseline I focused all my efforts on the non-technical skills of understanding my client, her learning style and behaviour, whereas in the competition environment I was able to concentrate purely on the technical skills of testing the athletes.”

This meant I was very clear entering the competition environment that my role was to conduct the lactate sampling so I would have to work independently as the Performance Director would solely be interested in the preparation and performance on the athletes. I had also formed a good relationship with other support staff, meaning I could ask them for information without distracting the Performance Director. I had also discussed with the Performance Director when she wished to receive the testing data and in what form. It was decided this would be after the competition and we would discuss the data once she had viewed it.

Spending four days with the Synchronised Swimming team confirmed my interpretation of the Performance Director’s behaviour. I felt even more comfortable with her questioning as she behaved the same way towards the other coaches, confirming it was purely her learning style rather than criticism.

Conclusion

Taking the time to understand the Performance Director helped me to tailor my service. Reflecting on my interactions with the Performance Director enabled a greater understanding of how my behaviours influenced her, both in a positive and negative way. This experience highlighted the importance of non-technical skills to make what was a basic physiological testing session successful and relevant to the client.

Supervisor’s Comment

From Sarah Hardman, English Institute of Sport Physiology Lead - South

Providing physiological support to elite athletes and coaches is challenging for the most experienced practitioner, particularly in competition period. As a BASES supervised experience candidate, having the opportunity to gain experience in high performance sport is a fantastic opportunity but one that comes with great responsibility.

Preparation is therefore key, no matter how short the duration of the experience. In this case Rachel proactively sought opportunities to make her understanding of the sport, knowledge collection and data gathering as good as it could be prior to delivering the requested support during the European Championships.

Combined with this, the relationships you establish with the coaches and athletes are crucial to a successful programme of physiological support. Establishing clear boundaries and expectations with personnel within the sport and on the periphery will help, particularly in times of high pressure. Rachel worked well in this example to spend additional time with the Performance Director and athletes in their training environment before travelling to competition with them. Furthermore, in the competition venue she worked hard to establish relationships with the event staff she needed to help her deliver her role.

As a supervisor it is important to help the supervisee understand the importance of the relationship both with the athlete and the coach. If you are to have any impact on performance, the coach has to be fully engaged with what you are doing. Without mutual trust and respect, providing a physiological intervention to aid an elite athlete’s performance is futile. Importantly, supervisees must recognise the limitations to what they can do in the circumstances presented and their experience to date. It’s a balancing act between working towards an idealistic approach, whilst recognising due to the nature of high performance sport, this cannot always be achieved.

Rachel Sheldrick is a Junior Rehabilitation Scientist at the English Institute of Sport working for the British Olympic Medical Institute’s Intensive Rehabilitation Unit. She is registered on BASES supervised experience.

Sarah Hardman is a BASES accredited sport and exercise scientist and is Lead Physiologist for English Institute of Sport South Region and Physiologist to the GB Rowing Team since 2007. She has experience as an applied practitioner in both Olympic and Paralympic sports.
What were your day-to-day responsibilities at the Rugby World Cup?

I had to involve everyone in setting meaningful goals for each game and every training session. We did this in small groups made up of units (front five, middle five and back five). On a rotational basis, a different player in each group was put in charge and he started the process by stating what his goals were. Everyone present was then allowed to ask questions and to comment. This procedure was then repeated for every player in the group. A technical coach was present in each group but was only allowed to ask questions. My other responsibilities involved one-to-one work with players and providing feedback to coaches.

What was the most enjoyable part of your role?

Having the privilege of working with our country's best players on the other side of the world and hearing them mention that something you have worked on with them has helped; client satisfaction and results have always been the two sources of feedback that I value the most.

What's the difference between your role at a tournament compared to the support you provide at home?

Time and pressure constraints were the main differences. Yes, we had longer to prepare for the World Cup than for any other tournament but, at the actual event, there were so many demands on the players' time and another game was never more than a few days away.

How did you manage your time in order to keep yourself refreshed?

Most of my work was completed by around 9.30pm each evening, so I would go out for a cup of tea with another coach, although we would typically talk rugby. The main thing was to get out of the hotel and find some time away from watching training, travelling, chatting with the players in the dining room or doing one-to-one work in the hotel. You have to find some downtime to help manage the pressure.

What one thing did you do that would surprise people as being part of your remit?

I guess, to provide critical feedback to the technical coaches by offering a non-coach's perspective. I've been involved in Coach Education for 30 years, so I think I know what good coaching looks like. I appealed to ten different criteria in providing this type of feedback, which have been tried and tested over the years.

What were the most challenging occurrences at the Rugby World Cup and how did you deal with them?

When you have a team on the ropes and you lose by one point, as we did against Argentina, you have to pick players up. It's heartbreaking when the team spurns chance after chance and this creates extreme emotions. I had to help them move on from this and get them into an analytical frame of mind. We had to answer why we had lost and learn lessons because we had our next game in 6 days. All the staff made a pact that we had to start looking forward from Monday lunchtime after the Sunday defeat. Unfortunately, the most important lesson didn't seem to be learned as we similarly gave a late try away against England as we did against Argentina. If the games were only 75 minutes long, we'd have won the group!

What advice would you give to those trainee sport scientists aspiring to support international athletes on the world stage?

Be prepared to work at a minute's notice; when an athlete wants to speak to you, you can't refuse. Be realistic about your own powers; remember there are some athletes that you can't help as it is outside your boundaries of knowledge and training.
Do our students have the “X Factor”? 
How do we provide our students with the best chance of getting on the career ladder? Are internships the answer? Helen Weavers gives her perspective.

According to the Office for National Statistics, graduate unemployment is at its highest for over a decade, with unemployment rising from 10.6% to 20% since 1995. This suggests that having a degree is not enough in the current climate for graduates to get on the “career ladder”. Specifically, sport and exercise science is a tough field to get a career in with approximately 10,000 places on sport-related degree programmes each year and therefore a large amount of graduates.

Internships are opportunities for individuals to gain practical applied experience in a supervised environment. These days there are many internships available within a variety of agencies, often unpaid but providing a chance to obtain applied experience in the relevant field. Since these are often aimed at graduates, the question is “How can we start providing opportunities for students to develop the necessary skills and experience earlier on?”

University of Dundee student internship model
The aim of the University of Dundee internship programme is to provide applied experience for Sports Biomedicine students to be selected to join our internship programme. The aim of the internship programme is to provide applied experience for the students to put their knowledge into practice and to enhance their employability. The internship provides experience of laboratory and field testing and is based on the “sports performance” area with supervision and guidance provided by experienced personnel.

Selection
Students are asked to submit an application form outlining any relevant experience they have and to include a personal statement. After an initial shortlist, there is an introductory session that outlines details regarding the internship programme and identifies expectations. A practical “interview” follows, which includes a field testing session so we can assess the student’s technical and people skills, which we believe are both key. This is a rigorous process to ensure the students understand the importance of the quality of what they deliver and we can judge which students we think would perform well as interns.

The programme
After selection, the interns are asked to sign a contact. This includes the requirement of achieving a specified academic level to ensure that they are not prioritising applied work over studies. The contract also emphasises the importance of confidentiality with client information and our high expectations of professional delivery. Over the academic year, opportunities arise for our interns to work with our clients or client groups. If extra training is required in certain areas, then this is also implemented throughout the year.

We try to provide as much variety as possible to allow a broad range of experience. Depending on the client group and the standard of the interns, interns are also offered opportunities to work autonomously but such sessions are led by an experienced intern and in these cases they would receive payment for leading a session due to the additional responsibility.

Voluntary or paid?
We have introduced a “bonus” payment for those who take part in a significant number of hours and show a high level of professionalism. Costs associated with the internship programme are accounted for within the client contracts.

Feedback from the interns
Annually we ask the interns to complete a questionnaire so we can evaluate the programme. Every year we receive positive feedback and have developed the programme based on the feedback and our own reflective practice. In general, the interns enjoy the applied work, believe that it benefits their studies and that it will enhance their employability. In particular, for enhancing personal development and employability, this year the interns rated this aspect 4.25 out of 5.

Summary
Overall, the internship programme provides added value and applied experience for students who are keen to pursue a career in sport and exercise science. The students are very positive about this experience and if we can support them to not only get on the career ladder, but to enjoy the journey as well, then we are on the right track. All students who have been involved in the internship programme and have graduated have gone on to further study or are in employment. Over half of these graduates remain within the field.

words: Helen Weavers
Helen Weavers is a BASES accredited sport and exercise scientist working at the University of Dundee. She has lectured on the Sports Biomedicine degree programme for eight years.
Developmental changes across applied sport and exercise scientists’ careers

Dr David Tod describes ways that applied sport and exercise scientists’ practices and emotions may change with experience. He also details some implications on which readers may reflect.

Two factors influencing effective sport and exercise science support include (a) the technical interventions and knowledge underpinning practice and (b) practitioners’ skills and characteristics. Across various sport and exercise science disciplines researchers have focused much attention on identifying and testing interventions to help clients achieve their goals. In comparison, much less research is focused on the service provider. To help address the imbalance, during the last 8 years, my colleagues and I have conducted over 100 interviews, across several cross-sectional and longitudinal studies, with 80 applied sport and exercise scientists, including exercise physiologists, strength and conditioning coaches, and sport psychologists, about their development (e.g., Tod, Andersen & Marchant, 2011; Tod, Bond & Lavallee, in press). We focused on two broad questions: How have practitioners changed with practice? and What influenced those changes? Answers to these questions may assist other practitioners to develop themselves and help educators prepare students for their careers.

Ways that applied sport and exercise scientists may develop

The following quote is from an applied sport and exercise scientist, with more than 30 years of experience, describing his professional development using a watch-making metaphor:

“If you want to be a sport scientist, watchmaker, or whatever, you have to go through an apprenticeship. The apprentice is hungry for knowledge and anxious if everything’s right. Worried about performing, because ‘I have got to make this watch that actually has to work.’ If you want to make watches, you have to be able to make a watch over and over again, to feel comfortable making watches. Then you can start making your own watches, and then you can add something to the watch, you can add a water pressure gauge, and now I can modify the watch. Once I get past my apprenticeship, then I become a journeyman, and as a journeyman I have more freedom, but I still want to consult other journeymen about my watches, and then I become, if I do really well, a master watchmaker. As a sport scientist I went through all that. Of course I did. I don’t see anybody who does not.”

His words illustrate several themes associated with applied sport and exercise scientist development that I describe in more detail below.

Movement from rigid to more flexible operational styles

Trainees typically behave in rigid ways, trying to adapt clients to fit the interventions they (trainees) have at their disposal. With experience, practitioners begin adapting interventions to suit athletes’ needs. For example, one strength and conditioning practitioner initially focused on improving clients’ strength in the bench, squat and power clean exercises, whereas with experience she began to realise she needed to develop flexibility in her programme design by focusing on the movements that athletes needed for performance.

Trainees may have difficulty adapting interventions to clients’ needs because they can be distracted during service delivery by their own cognitive activity (e.g., beliefs, expectations, emotions, perceptions). Trainees are often “coaching” themselves through sessions, and recalling advice from supervisors. One psychology trainee, for example, described that he didn’t just have the voice of Homer Simpson in his head, referring to his own cognitive activity, but he had to contend with the voices of the entire Simpson family referring to his recalling of advice and information from supervisors, colleagues, readings, etc. Like the Simpson family, domestic chaos prevailed. As he developed competence, the internal Simpson family reduced and he was able to focus better on clients.

Greater understanding of the service-delivery relationship

With experience practitioners may start collaborating more with clients and recognise with greater insight the roles that relationships and athlete “buy-in” play in service delivery. Typically, trainees acknowledge that client relationships influence service delivery, but their understanding lacks the depth of knowledge arising from having interacted with athletes over time. For example, in one longitudinal study, a sport psychologist initially described good client relationships as those in which he and the other person liked each other. When we interviewed him six years later, he explained that good working relationships, in addition to having good “vibes”, also involved a clear understanding of the goals the individuals were working towards and how those objectives were best achieved.

“Trainees typically behave in rigid ways, trying to adapt clients to fit the interventions they (trainees) have at their disposal. With experience, practitioners begin adapting interventions to suit athletes’ needs.”

Greater awareness of how they (practitioners) influence service delivery

Along with recognising the importance of relationships and athlete buy-in, practitioners may also become more aware of how their characteristics, histories and interpersonal behaviour patterns help or hinder service delivery effectiveness. In our interviews, it was sport psychologists that most often discussed the value of self-awareness, perhaps because they recognise they are the service-delivery instrument, whereas other sport and exercise scientists might be distracted by their equipment. Nevertheless, experienced physiologists and strength and conditioning coaches also discussed how self-awareness helped them identify their strengths and limitations as practitioners.

Decreased anxiety and increased confidence

Most interviewees admitted to experiencing anxiety when first working with athletes. Although excited to be helping people, often trainees also question their competence. In the absence of having successfully helped athletes, trainees may have difficulty rebuiting their self-doubts. Situational and personal factors influenced interviewees’ anxieties, such as the presence of empathetic supervisors or their own sporting experiences. Some exercise physiologists, for example, discussed how they drew on their own sporting experiences to help quell their anxieties. As interviewees worked with athletes, their anxieties reduced and their confidence grew, an observation coherent with Bandura’s (1997) theory in which...
performance accomplishment is a major contributor to self-efficacy. Although anxiety typically reduces over time, practitioners might find their anxieties increase when their work environment or client population changes. One highly published academic, for example, discussed how he felt anxious when moving from academia to a national sporting institute because he perceived some of his new colleagues doubted academics could make good practitioners (despite having over 15 years of applied experience before moving).

**Practical implications**

**Gain as much work experience as possible**

Interviewees repeatedly discussed the value of work experience in their development, a theme also often advocated by contributors to *The Sport and Exercise Scientist*, and recognised by BASES in the supervised experience pathway. Additionally, our seasoned interviewees discussed how they are still learning, even after 10, 20 or more years. Professional development is a career-long process because the environmental and personal demands practitioners face keep changing. For example, they may change jobs or work with new populations, and research may lead to novel interventions. Understanding that professional development involves a continual reconfiguration of competencies to meet ever-changing demands may help practitioners commit to professional development throughout their careers.

**Engage in self-reflection**

The oracle of Delphi’s advice to “know thyself” may remind practitioners of the value of reflecting on their knowledge and skills. Understanding one’s strengths and weaknesses may be enhanced through reflective practice. Interviewees frequently discussed the benefits they obtained from deliberate and regular reflection. In recent years reflective practice has become increasingly recognised as a key learning process underpinning much practitioner development (see Cropley et al., last issue, for more information).

**Surround yourself with colleagues and mentors**

Reflective practice does not need to be a solitary affair; much learning occurs when colleagues interact, a theme acknowledged by interviewees. When discussing the value of collegial networks, interviewees frequently talked about their mentors and supervisors. Well-chosen supervisors contribute much to practitioners’ development, although identifying suitable individuals merits thought and consideration. For example, recently Australian sport psychologists discussed how their supervisors who were academics had been less helpful for their development than their supervisors who had been full-time practitioners (Tod, Marchant & Andersen, 2007). Supervisors without several thousand hours of athlete interaction may not have the breadth of service-delivery experience needed to have encountered the full range of issues practitioners bring to supervision. Sometimes it may not be easy to find suitable supervisors because of location or cost. In such cases, supervisors may help by developing a network of colleagues with different specialties that may help address areas where they (supervisors) may be lacking.

**View anxiety as a normal and helpful emotion**

Trainees may be comforted to learn most practitioners experience anxiety when first helping athletes. Trainees who experience high levels of anxiety may benefit from empathetic supervisors who can help them manage their emotions. Strategies that may assist include preparation through role plays, supervised exposure and cognitive restructuring. Trainees, however, may benefit from exploring their anxieties rather than trying to reduce them. Exploring reasons for being anxious may help identify areas in which practitioners can improve their competence. For example, practitioners’ nerves about an upcoming testing session may be because of insufficient practice using the equipment and they do not have a clear mental or written checklist to guide behaviour.

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**References**


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Dr David Tod

Dr David Tod is a Senior Lecturer in the Department of Sport and Exercise Science, Aberystwyth University. He is a member of both BASES and the British Psychological Society.
Interview with Dr Heather Lunt

This year, the Professor Tom Reilly Doctoral Dissertation of the Year Award was given to Dr Heather Lunt for her thesis entitled “Cross adaptation: The effect cold habituation has on the physiological responses to acute hypoxia in humans.” Here, Heather reflects on her PhD experience.

Could you give us a brief background to this area of research?

Environmental stressors often come in combination (e.g., altitude and cold). The thesis detailed an original concept of environmental cross-adaptation in humans; the influence that adaptation to one environment has on the responses to a different environmental stressor.

What are the main findings from your thesis?

The results presented provide the first evidence of a cross-adaptation between cold habituation and hypoxic exposures in humans. This was not found in a control group, where participants were exposed to thermo-neutral water immersions. Cold habituation reduced the sympathetic response to the acute hypoxic stimulus during loaded cycling (Lunt et al., 2010). In this respect cross-adaptation follows the principle of the general adaptation syndrome theory (Selye, 1950), whereby the same general responses occur to different stimuli. There are many differences in the adaptive responses to cold and hypoxia. Yet, some of the initial autonomic nervous system responses to hypoxic and cold environments are similar (e.g., elevated cardio-respiratory activity), which are driven by changes in autonomic balance.

What is the functional significance of this research?

The combination of environmental adaptations or the influence a previous adaptation has on the response to another environment has implications for athletic training, the military and mountaineers, as travel between locations can be undertaken rapidly. The proposed cross-adaptation pathway may reduce the autonomic nervous system response to exercise in hypoxia and enable athletes to train for longer or at higher intensities whilst at altitude than they previously may have been able to. Before recommending this approach, further research is needed.

What is novel about this research?

Although the concept of cross-adaptation is not new, previous research has focused on rodent models. This research was the first to study cross-adaptation (between cold habituation and acute hypoxic exposures) in humans. Previous research offered no rationale for these phenomena. The research undertaken here proposes a possible mechanistic explanation.

What is the key paper from this research area that you would recommend?

LeBlanc (1969). It contains a number of experiments that he and his team performed using rodents. This comes with caveats attached, extrapolating rodent data to humans and the inclusion of multiple experiments in one paper is something that would not be encouraged today, but the inventiveness and scope of the paper is interesting. The experiment he details where rats were cold habituated followed by exposure to hypoxia helped me to develop the question for my thesis.

What would your best piece of advice for those embarking upon a PhD?

I was given an article to read just after starting my PhD entitled ‘The importance of stupidity in research’ (Schwartz, 2008). You start a PhD, having passed most exams with flying colours. You are used to knowing, now you are at the cutting edge of science where no one knows the answer, this can be difficult to comprehend. This article helped to prepare me for that rollercoaster ride; in so much that the process of a PhD is about investigating an area no one has looked at before.

Dr Heather Lunt

Dr Heather Lunt studied for her PhD in the Extreme Environments laboratory within the Department of Sport and Exercise Science at the University of Portsmouth, where she now works as a Senior Research Associate.

Compiled by: Dr Emma Ross
Senior Lecturer in Sport and Exercise Physiology, University of Brighton

Resources:


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University of Portsmouth
Heard of nudge theory? Could behavioural economics help increase the nation's activity levels? We know that England's Chief Medical Officer has called physical activity a potential “wonder drug” and yet we have little investment in finding methods of making this wonder drug more palatable to more people more often.

Nudge theory is where economics meets psychology and has support from governments on all sides. The idea is that the best [economic] option for people’s behaviour is highlighted but they do not have to do it. Examples include being automatically enrolled in a company pension scheme but with the chance to opt out. Governments like this approach because it is cheap and because they cannot be accused of running a “nanny” state. Can this work for promotion of physical activity? One example is bike loan schemes such as we see in Dublin, Barcelona and London. Such schemes operate by making cycling much more of the social norm [linking to the psychological theory of planned behaviour], which encourages more people to cycle or even to buy their own bikes – and there is some evidence that this has happened.

“Nudge theory has been criticised by both psychologists and the medical profession as more of fudge than a nudge - fudging the issue of not spending sufficient money to target those populations most in need of the behaviour in question.”

Economic and environmental benefits are clear in this example.

This all sounds very fine but nudge theory has been criticised by both psychologists and the medical profession as more of fudge than a nudge - fudging the issue of not spending sufficient money to target those populations most in need of the behaviour in question. This reminds me of a long standing debate in the physical activity literature about the role of the environment – making an environment more positive for physical activity may not be sufficient to change physical activity levels but it may be a necessary aspect of more direct behaviour change approaches.

If nudge theory can help us sell our wonder drug we need a host of creative ideas about ways in which this can be done – can you contribute some?

Further Reading

BASES Student Conference 2012
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Olympic and Paralympic Athletes: Research and Applied Perspectives

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Registration opens: Monday 28th November 2011
Abstract submission deadline: Friday 24th February 2012
Re-submission of abstracts: Monday 12th March 2012

www.bases.org.uk/student-conference
Books

**Athlete First: A History of the Paralympic Movement**
Wiley-Blackwell
Cost: £61.75 (hardback from Amazon)
Bailey provides a detailed history of the origins and development of the Paralympic movement. Yet whilst the text provides a unique narrative based on a wide range of resources there are some issues with regards to the accessibility of the text. Firstly I believe the title is misleading. I was excited at the prospect of an ‘athlete’ focused text but this is certainly not the case, a more representative title would be “A History of the Paralympic Movement”. Whilst the content is relevant I wouldn’t recommend this as a student text mainly due to the lack of student- or indeed lecturer-friendly resources. From a researcher or general interest perspective the book contains a lot of new and relevant data such as participation information and details of when and how new sports were introduced to the Paralympic Games. However, with regards to using this book as a resource I found it frustrating that this level of factual information wasn’t consistently present for all Games. If read cover to cover this text provides an interesting narrative relating to the history of the development of the Paralympic Games but it is not a resource to easy dip in and out of.
**Rating 5/10**
Reviewed by Donna de Haan, Hogeschool van Amsterdam/ University of Applied Sciences, Netherlands

**An Introduction to Drugs in Sport: Addicted to Winning?**
Routledge
Cost: £24.78 (paperback from Amazon)
The book considers the issue of drug use in elite sports through the critical lens of processesociology. One of the strengths of this book and the sociological framework employed is an emphasis on approaching drug use in sports and in wider society from a critical historical perspective. This means that it is not only a snapshot of current regulations and practices, but due consideration is also given to specific and wider socio-historical processes that have contributed to and influenced our contemporary perception of illicit performance enhancement. In addition, by discussing a wide range of socio-cultural factors that have been instrumental in changing social attitudes to and, in turn, social policies regarding drug taking practices in sports, the authors move away from a mono-causalistic view and provide a more reality-congruent picture of the subject at hand. This book includes a broad range of historical and contemporary examples of illicit performance enhancement. In addition, by discussing a wide range of socio-cultural factors that have been instrumental in changing social attitudes to and, in turn, social policies regarding drug taking practices in sports, the authors move away from a mono-causalistic view and provide a more reality-congruent picture of the subject at hand. This book includes a broad range of historical and contemporary examples of illicit performance enhancement.
**Rating 8/10**
Reviewed by Dr Gyozo Molnar, University of Worcester

**Living in the Sweet Spot: Preparing for Performance in Sport and Life**
Baltzell, A. L. (2011)
Fitness Information Technology
Cost: £13.59 (paperback from Amazon)
It’s official; there is no further need to distinguish between the choice of being happy or achieving your goals. With the help of this book you can realistically achieve both. A fully digestible feast of positively focused research communicated articularly in a logical user-friendly fashion means that this book could be either devoured whole, or used for reference. Brimming with personal experiences both as an elite athlete and a sport psychologist Baltzell presents innovative solutions to common everyday performance psychology challenges. The fitting undertones of Positive Psychology are the basis upon which numerous practical exercises are proposed to aid the acquisition of the key mental skills required to live in the Sweet Spot. This is a highly recommended read for athletes, psychologists and a wider audience looking for the low down on performance optimisation. The book contains beautifully written, engaging accounts of laying the foundations of a successful mindset, preparing for performance and competing on the day. Particularly informative and borderline revelatory is the insight into how to train, maintain and adapt our motivational orientation during competition to secure optimal performance levels. This book has the potential to be a performance bible for all of us pursuing that last 2%.
**Rating 9/10**
Reviewed by Claire-Marie Roberts, University of Glamorgan

**Racing Through the Dark: The Fall and Rise of David Millar**
Orion
Cost: £6.29 (paperback from Amazon); £9.99 (Kindle eBook from Amazon)
The fervour surrounding British Cycling continues with another incredible Tour de France this year, not to mention wins for Cavendish on the Olympic course at the London test event and at the World Road Race Championships – supported by what has been hailed as an exceptional team effort. And so another cycling biography. David Millar was banned from the sport for two years following the highly-publicised Team Cofidis case in 2004. Millar’s story is an open and honest account of his journey from a position of dogged determination to succeed as a clean athlete to one of capitulation to the pressures of the sport … and back again. The reader glimpses a fascinating insight into the world of pro cycling, revealing some of the attitudes and organisation of the sport, which at times appear surprisingly amateurish compared to those in many of today’s Olympic programmes. Despite still serving a lifetime ban from Olympic competition, Millar is zealous in his approach and his commitment to changing the sport and the attitude of its young riders. This book is of obvious appeal to the cycling fan, but more than that, it’s a fascinating insight into the world of professional sport, doping and redemption.
**Rating 8/10**
Reviewed by Dr Ken van Someren FBASES, English Institute of Sport

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Realising the importance of effective needs analysis, creativity and reflection

In this their final article of their supervised experience diary Louise Croft and Nicola Gerrett share their experiences of their supervised experience journey.

What would you do differently?
Louise: Reflective practice! I have read about it and knew all the benefits but trying to stay on top of it is difficult. I would have definitely spent more time on this, even if it was just a few words in a diary about my experiences of testing. Thinking about what I learnt from each testing session and how I could improve on my last performance was really useful.

Nicola: I was really motivated at the start to make the most out of the supervised experience scheme but this motivation soon dwindled once my other work load mounted up. In hindsight, I should have set myself goals with my supervisor to complete every 3 months and structured my experience, rather than rushing to achieve my goals when the annual reports were due in.

What has been your smartest move?
Nicola: We both set up strong contacts in our first year, which have been fundamental to our supervised experience journey. I have provided support for a ladies hockey team for the last three seasons. This progressed from doing a few basic field fitness tests with the whole team to working with individuals in the laboratory and providing individual training goals. This will be part of my case study for my final year report, so setting the foundations in the first year and building on these relationships has worked really well.

What has been your most valuable experience?
Louise: I have worked with an elite double-amputee marathon runner and have tested him at various points in his training career and provided feedback regarding his progress. This has been a very unique and invaluable experience and I have learnt how to adapt standardised test protocols to suit my client’s needs.

Nicola: I was really motivated at the start to make the most out of the supervised experience scheme but this motivation soon dwindled once my other work load mounted up. In hindsight, I should have set myself goals with my supervisor to complete every 3 months and structured my experience, rather than rushing to achieve my goals when the annual reports were due in.

What lessons have you learnt?
Louise: It is vital to conduct a thorough needs analysis and find out what the athlete wants to achieve from working with you. The supervised experience programme is not about ticking boxes for your own experience. We used a triangulation approach (see Thelwell & Maynard, 2002), which involved performance profiling (see Bulter & Hardy, 1992), questionnaires about training and performance goals and set physiological tests to get a better understanding of his training and performance needs. These three basic steps were repeated each time we met to assess his progress. I think this is important as progress is monitored in a structured way, objectively and subjectively.

Nicola: I’ve learnt not to panic if athletes don’t turn up for testing! Whilst I want things to run smoothly, I’ve learnt to accept that field equipment may not work, so you must remember spare equipment or a Plan B so the athlete gets something out of the session. I am now much better at staying focused and learning to adapt my schedule and tests to suit the situation.

How do you both differ as sports scientists?
Nicola: From when we started it was clear that we had different interests based on our PhD projects and the athletes we intended to work with. I have always been hesitant on adapting protocols and try to follow the book to allow for comparisons. However, I think Louise’s experience of working with disabled athletes has taught her differently and this is something I have tried to improve on. I think working together has widened our perspectives and challenged our ideas.

Louise: I had to adapt protocols but my philosophy throughout this process has been practice makes perfect and time spent in the lab preparing and testing is time well spent to gain confidence and to improve your skills. I’d advise others to not rush through supervised experience, especially in the first year. Plan and take your time.

Supervisor comment
By Dr Vicky Tolfrey FBASES
The BASES supervised experience journeys for both Louise and Nicola may have taken different paths yet eventually they should both reach a positive outcome. I think that alongside their PhD studies Louise and Nicola have grown in confidence and are able to link science to sports practice, both in scientific presentations as well as on the working floor with their clients. They have increased their appreciation for creativity with the development of designing suitable test protocols and/or a training intervention, which is an important aspect of thinking that can be used to all areas of life. As both students have highlighted, time to reflect is a “must” and time must be given to the planning stage of each supervised experience year. It is not just me who challenges reflection and planning in their supervision, as the feedback given each year through the external review of the annual submissions is an essential feature of this learning process.

Dr Vicky Tolfrey FBASES
Dr Vicky Tolfrey FBASES is the director of the Peter Harrison Centre for Disability Sport, Loughborough University. She is a BASES accredited sport and exercise scientist.

Nicola Gerrett and Louise Croft
Nicola Gerrett is a full-time PhD student at Loughborough University. Louise Croft is an associate teaching fellow at Exeter University. They started the BASES supervised experience scheme in April 2009 under the supervision of Dr Vicky Tolfrey FBASES.

Resources:
Thermal physiology

Dr Mike Price provides a brief overview of a study investigating the effects of 7-days heat acclimation in persons with spinal cord injury, including how the study came about, what the main findings were and his reflections on developing international collaborations and working in a laboratory in the United States.

How the study came about
As part of Coventry University's drive to develop collaborative links, I was awarded an internal Applied Research Fellowship. This award enabled me to work with a physician specialising in spinal cord medicine at the Veterans Affairs Hospital in Palo Alto, California, with the research eventually taking place in collaboration with both the Veterans Hospital and the Department of Biological Sciences at Stanford University, California.

There were two visits planned for the collaboration. First, an initial visit for trouble shooting, confirming protocols and equipment, training staff and applying for ethics approval via their Institutional Review Board (known as the “IRB”). Additionally, I was invited to give a presentation to the medical staff of the Veterans Hospital relating to my previous work and the research we proposed to undertake.

The presentation provided not only a great opportunity to gain feedback from a clinical perspective, but also to field questions from a very knowledgeable and experienced group of clinicians with interests arising from perspectives other than those I have experienced at most conferences. Working on the IRB application was also an invaluable experience, particularly the process of translating the consent and participant information documents into Spanish (California has a large Spanish speaking population). Separate translations from English to Spanish and then Spanish to English had to be undertaken to help ensure that the details matched exactly. It was also useful to experience the training that staff had to undertake to be able to transport blood samples between laboratories.

The second visit involved collecting data for the first three participants. The experimental work was undertaken in the environmental chamber of the Department of Biological Sciences at Stanford University, where existing links with the Veterans Hospital existed. The chamber was housed in laboratories of Drs Dennis Grahn and Craig Heller who pioneered the AVACore cooling device (e.g., see Grahn et al., 2005). This provided an excellent opportunity to discuss thermal physiology and cooling methods with these well-known researchers.

Main findings of the study
The study involved persons with spinal cord injury. These individuals demonstrate a reduced sweating capacity below the level of injury (Price, 2006), and might therefore not be able to acclimate to exercise and heat stress as able-bodied persons do. The aim of the study was to examine the effects of heat acclimation in persons with paraplegia or tetraplegia.

Below is a table showing the responses of paraplegics and tetraplegics during exercise at 50% of peak power output on seven consecutive days (35 °C and 40% relative humidity). Aural and skin temperatures and ratings of perceived thermal strain were recorded. There were no differences in aural or mean skin temperatures or heart rate during exercise between day 1 and day 7 of heat acclimation for either group (P<0.05). Perceived thermal strain was reduced on day 7 when compared to day 1 for the paraplegics (main effect for day; P<0.05), but not the tetraplegics.

Overall, these results suggested that a 7-day heat acclimation period did not reduce thermal strain for paraplegics and tetraplegics, although perceptual responses might be altered in some participants. The lack of thermal adaptations was most likely due to the reduced or absent sweating capacity being unable to produce sweat rates of sufficient magnitude to induce thermoregulatory adaptations.

Final reflections and advice
The most important advice is that development of research collaborations is often dependent on successful networking, with conferences providing a good opportunity to network with researchers in your area. Five persons with paraplegia and five with tetraplegia undertook 30 minutes of arm-crank exercise at 50% of peak power output on seven consecutive days (35 °C and 40% relative humidity). Aural and skin temperatures and ratings of perceived thermal strain were recorded. There were no differences in aural or mean skin temperatures or heart rate during exercise between day 1 and day 7 of heat acclimation for either group (P<0.05). Perceived thermal strain was reduced on day 7 when compared to day 1 for the paraplegics (main effect for day; P<0.05), but not the tetraplegics.

Overall, these results suggested that a 7-day heat acclimation period did not reduce thermal strain for paraplegics and tetraplegics, although perceptual responses might be altered in some participants. The lack of thermal adaptations was most likely due to the reduced or absent sweating capacity being unable to produce sweat rates of sufficient magnitude to induce thermoregulatory adaptations.

The most important advice is that development of research collaborations is often dependent on successful networking, with conferences providing a good opportunity to network with researchers in your area. Furthermore, don’t give up on collaborations if they don’t develop as initially hoped for and make the most of any visit you take to another laboratory or research group by presenting your work.
You started your talk with “the more I learn about fatigue, the less I know.” This will have rung true with many scientists studying in this area! Researchers have tried to model fatigue, but no one model seems to satisfy its complexities – is that what makes it such an interesting phenomenon to investigate?

One of the fundamental attractions of studying sport and exercise sciences is that we deal with real-life issues, and fatigue is certainly something we have all encountered. Our challenge is to mesh real-world experiences with protocols that can be controlled in a laboratory. The classic approach used by physiologists has been to quantify fatigue with a single dependent measure, such as a decline in either the maximal force or power produced by a muscle. The limitation of this approach, however, is that it essentially ignores the activity-related adjustments in sensation that can also contribute to fatigue. For example, some groups of individuals, such as those with neurological illnesses, can even report a sense of fatigue in the absence of physical activity. The field has not yet reached a consensus on how we should accommodate these various perspectives. The most common approach is to precede the word “fatigue” with an adjective, such as muscle fatigue, peripheral fatigue, central fatigue, mental fatigue, multiple sclerosis fatigue, and so on. A more elegant solution, however, is to develop a more inclusive construct for fatigue that can satisfy all the relevant stakeholders. Because the field has not yet achieved such a consensus, the study of fatigue continues to be interesting.

You explained that your approach to studying something that is hard to understand, is to go back to how it is measured. The trouble is divergent results are produced when you study fatigue using different measurement paradigms (such as isometric force versus isokinetic torque). How does this affect the development of your research questions and design of your experiments?

Although I often find it helpful to remind myself about how a specific quantity is measured, this is not the case with fatigue. One aspect of fatigue that is agreed upon by most investigators is that it can be caused by many different factors. Consequently, the impairments responsible for fatigue in one condition can be quite different from those that contribute to fatigue in another condition. Rather than using a standardised protocol to assess the level of fatigueability exhibited by the muscles of different individuals, therefore, a more prudent approach is to work backwards from an observation to identify the underlying mechanisms. To learn about the fatigue experienced by individuals with multiple sclerosis, for example, a sound approach would be to determine the laboratory tests that are associated with the sense of fatigue reported by these individuals and then to identify the physiological and psychological impairments that are associated with the values achieved on these laboratory tests. If your assessment is correct, then an intervention that reduces these impairments should also improve the fatigue reported by these individuals.

You made an important point in your presentation that is sometimes overlooked; fatigue is a symptom that limits physical performance and as such, there is a big perceptual element to fatigue. Do you think current researchers are integrative enough in their approach to studying fatigue – the area seems ripe for cross-discipline collaboration (such as psychologists working alongside physiologists); is this something we need more of to advance our understanding of the area?

Most studies of fatigue are too limited, but this is mainly because there is no consensus on the meaning of the word. If you accept the construct that fatigue is a disabling symptom then studies of fatigue need to involve a broad range of investigators who can address the many aspects that could contribute to the symptom. The experience of the investigative team, however, would depend on the target population. At the very least, however, the study of fatigue as a symptom in humans does require expertise in both physiology and psychology.

Your book “Neuromechanics of Human Movement” is a must-have text for aspiring sport and exercise scientists. What words of advice would you give to young researchers embarking upon their academic career?

Be informed before you choose a career in academia. The profession has become increasingly challenging in recent years and it is not for the faint of heart. If in doubt, get a real job.

Do you have a “must read” paper or book which really inspired/continues to motivate your interest in the area of neuromuscular fatigue?

Angelo Mosso introduced many of the contemporary issues related to the study of fatigue in his 1904 (English translation) book on “Fatigue”. This book will keep you grounded if you are interested in fatigue.
The final push

With less than nine months until the London 2012 Olympic and Paralympic Games, Declan Gamble and Dr Ken van Someren FBASES consider this winter’s training priorities for athletes in their final year of preparation.

End of year reviews
With the penultimate year of this Olympic cycle recently completed, many athletes and coaches have now had the opportunity to reflect on their performances during recent European and World Championships. For some athletes, Olympic qualification and selection will have been accomplished; for others, podium places and personal bests will provide evidence that progress is on track and qualification is within grasp. The end of year review also enables members of the support team to reflect and evaluate the effectiveness of their own interventions. Simple questions such as: What interventions influenced performance (positively), what interventions did not work, and what other interventions could potentially be implemented, can provide the basis for the honest discussion necessary to ensure that optimising the athlete’s performance is the key objective of the support that is provided. Moreover, this integrated forum can promote shared learning and subsequently inform the development of the training and service goals for each phase of the new training programme.

So what is the focus for the year ahead?
For many athletes, now is the time to prioritise being injury free, to put together a productive winter of training, and to fine-tune their technique and fitness. For support staff, the focus should be helping coach and athlete achieve robust performance through the year’s training and competition. The stepwise innovations should have already been implemented and tested. For example, significant interventions in training and recovery methods made and various nutritional strategies trialled. Now it’s a case of ensuring the application of the very best knowledge and practice acquired over previous years. By now there should also be an effective athlete “dashboard” in place (i.e., the key metrics and indices that objectively monitor the athlete’s health and training status). This will be highly valuable to monitor training progression and to help manage the risk of excessive fatigue, illness and injury. Athlete, coach and scientist confidence in such tools can be critical at this stage, but of course if it’s not there now, then it won’t be achieved in just one year!

The transition period and winter training
Before training is recommenced the importance of the off-season, or transition period, cannot be underestimated. Next year will be incredibly intense and at the end of a long, hard season athletes and coaches (and indeed support staff) need time to unwind from the rigours of daily training and the stress of international competition. Following the rejuvenating break, each phase of training should have a specific goal. By profiling physical and physiological status, support staff can assist with benchmarking and establishing training priorities. Many athletes will have approached the Olympic quadrennial as a four year training cycle; however, for most the initial focus during the autumn and winter months is the further development of a foundation base of conditioning and focusing on enhancing resilience through injury prevention strategies. After all, the best training in the world will count for little if injuries are carried into next year’s competition. This phase will therefore give the strength and conditioning coaches and physiotherapists an opportunity to address any musculo-skeletal weaknesses and potential injury concerns.

The demands of international competition and the associated travel requirements experienced by athletes vary from sport to sport, with some athletes spending up to 3-6 months abroad at warm weather and altitude training bases for training and/or acclimatisation. The transition period offers welcome respite from the stress of travelling; however, for many athletes it’s not long before they’re back on the plane for sojourns of warm weather or altitude training. Altitude training has become increasingly popular in endurance and middle-distance events with many sports spending periods of their winter training in venues such as Colorado, Sierra Nevada, Kenya or South Africa. For others, the use of simulated altitude and hypoxic environments may be preferable with hypoxic chambers, tents and portable generators providing myriad live/train-high/low combinations. Whatever method is used will likely have been trialled, and ideally perfected, over the previous years.

Regardless of the training environment, the winter preparation phase is essential for setting the physical and physiological foundations for the tougher training that is to follow. The length of the training phase will vary with some athletes needing to find “early form” to maintain or improve their world and/or Olympic rankings and/or to secure their place at the Games – either through international qualification or national selection.

Conclusion
Undoubtedly, huge sacrifices will be made by athletes, coaches and support staff. However, the application, commitment, dedication and perseverance of the whole team, will be worth it next year when we see our athletes compete and succeed at the pinnacle of their sports. Good luck to all!

Declan Gamble

Dr Ken van Someren FBASES
Dr Ken van Someren FBASES is the Director of Sport Sciences at the English Institute of Sport.

Declan Gamble
Declan Gamble is a BASES accredited sport and exercise scientist and leads the Performance Science team at the Sports Institute Northern Ireland, delivering physiological services to the Commonwealth and Olympic programmes.
As the season of goodwill is almost upon us, I am reminded of Carl Sagan and this curious sounding heading. Sagan was an astrophysicist and in the 1960s, among his other roles, was a visiting scientist to NASA’s Jet Propulsion Laboratory. In the 1980s he presented Cosmos, a thirteen-episode television series. Some readers might remember his mellifluous tones as he led us through the marvels of extraterrestrial travel.

Sagan contributed to Voyager 1, a space probe that was launched in September 1977 to study the outer solar system. In 1990 when Voyager was some 6 billion kilometres from earth, it had completed its primary mission and at Sagan’s request, the craft was commanded to turn its camera around and take an image of the planet from which it had departed. In the cosmic dust, earth was barely visible, but it could be distinguished as a pale blue dot.

In 1994, Sagan wrote a description of what could be seen. It is a particularly moving piece. I have the picture and Sagan’s narrative in a prominent position in my office. Later, Sagan was recorded as he gave an oration of his writing. Do a web search using “pale blue dot carl sagan” as the search term to hear that oration. It lasts just under four minutes. You will perhaps see why Pale Blue Dot has so much meaning for me and why it seems appropriate at this time of year in particular.


Point to ponder - Prof Edward M Winter FBASES
Final word with Dr Joanna Scurr FBASES

One journal article or book that I think all sport and exercise scientists should read
Bad Science by Dr Ben Goldacre. Ben is an author, broadcaster, medical doctor and most importantly for me, an academic. I sometimes think the best way to describe a paradigm is to consider what happens when it goes wrong. This book cleverly uses unsubstantiated scientific claims, to outline appropriate scientific research methods. The book is an easy read for all in sport and exercise science, with an entertaining and often amusing style. I like the fact that it presents some controversial discussions of topic areas that cross into sport and exercise science.

One moment that changed the course of my career
My day to day role involves the coordination of a Research Group in Breast Health at the University of Portsmouth. When commencing research in this area (six years ago), our research hit the headlines, generating some favourable and some less favourable media coverage (with the Daily Sport headline “Jiggling your Jugs” being a particularly memorable one!). As an academic and a scientist, I was concerned that the more frivolous reports may undermine the important fundamental and applied research that we were/are undertaking. However, this media coverage prompted a barrage of e-mails from women thanking me for the work that we were/are undertaking. One particular e-mail from a 42 year old Chief Executive Officer of a charitable trust, told of how at 15 years old, she was competing in the 1,500 m final at her school sports day and the commentator commented on her bouncing breast over the loudspeaker. As a result of this she has not run since. Another example was an exacerbated e-mail from the mother of a 16 year old female basketball player (county level) who had been told to give up playing basketball due to the size of her breasts!

This was a turning point in my career, I realised that applied research in sport and exercise science has the opportunity to change people’s lives! With the up and coming Research Excellence Framework, it is interesting to consider the above examples in terms of defining and categorising the impact of the research that we undertake in sport and exercise science.

One thing that made me want to be a sport and exercise scientist
I thoroughly enjoy the dynamism and vibrancy of working within sport and exercise science. It has afforded me the opportunity to flourish and develop a career in a forward thinking arena with likeminded individuals. I recognise the importance of collaboration, particularly in the challenging times that lie ahead for Higher Education. I view collaboration as a chance to interact and learn from others within sport and exercise science and I see this as a pleasure, never a chore.

One quote that I really like
“If you have a good idea, go ahead and do it. It’s much easier to apologise than it is to get permission.” Admiral Grace Murray Hopper, 1906-1992, lecturer for the United States Naval Reserve.

Dr Joanna Scurr FBASES is a Reader in Biomechanics at the University of Portsmouth. She is a BASES accredited sport and exercise scientist and is on the BASES awards committee.

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