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“As physical activity advocates perhaps we should advise people to take a different approach so that next time they see a moving walkway or escalator, they stay clear but try to keep pace with those who have made the less active choice.”
Prof Marie Murphy FBASES, p11

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Aim: The BASES Expert Statement Grants aim to assist the development of expert statements on broad topics, related to the application of scientific principles to sport and exercise science, about which there is interest, confusion, or controversy. The statements are to be written for all persons interested in sport and/or exercise sciences and answer the following questions: What is the role of sport and/or exercise science within this topic? Why is this topic important? What are the issues and what evidence is available? What conclusions can be drawn?

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- Each application is assessed against the following criteria:
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  3. The expertise of the development team
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BASES Certified Exercise Practitioner

Martyn Anderton, University of Cumbria and Florencio Tenllado Vallejo, University of Malaya.

BASES Annual General Meeting

All BASES members are invited to the 2015 BASES Annual General Meeting (AGM) on Tuesday 1 December (6.30 - 7.30 pm) in The Graham Taylor Room at St. George’s Park. This is your opportunity to meet the Board and contribute your views and ideas.

Letters

BASES and GlaxoSmithKline (GSK)

The briefest of internet searches reveals that; “In 2012 GSK pleaded guilty to criminal charges in the United States, and agreed to pay a $3 billion (£1.9bn) settlement, including a criminal fine of $1 billion. It was the largest health-care fraud case to date in that country and the largest settlement by a drug company. The charges related to GSK’s promotion of drugs for unapproved uses, including the anti-depressants Paxil and Wellbutrin, failure to report safety data about the diabetes drug Avandia, reporting false prices to Medicaid, and kickbacks to physicians” (1). Anyone working in mental health will be fully aware of the medical concerns and controversy regarding Paxil (also known as Seroxat, or paroxetine) (2).

Whilst GSK claims that it has since redefined its business approach, in 2014 The Guardian newspaper reported that; “Britain’s Serious Fraud Office has launched a formal criminal investigation into GlaxoSmithKline’s sales practices, piling further pressure on the drugmaker which is already being investigated by Chinese authorities and elsewhere amid allegations of bribery” (3).

Older BASES members will also recall that GSK made and marketed Ribena (which any reasonable person would probably describe as tooth-rot, although one version was heavily advertised, quite unbelievably, as tooth-kind), only selling on this flavoured sugar water, along with Lucozade, in 2013.

Carl Heneghan and colleagues have elsewhere reported on the poor quality of commercially funded ‘sports drinks’ research in their paper, Forty years of sports performance research and little insight gained (4). Professor Tim Noakes has additionally pointed out what he believes happens to science and the search for ‘truth’ when research and subsequent consensus statements are influenced by commercial organisations and individuals with affiliations and allegiances to specific companies (5).

In light of the above, whilst claiming nothing improper or untoward in the slightest, I raise three ethical questions. Should BASES have GSK as a conference sponsor? Should the BASES conference organising committee include two representatives from GSK? What might all of this say to external observers about the integrity of BASES as an organisation?

Sincerely, TONY LYCHOLAT

References

The BASES Board response:

The partnership is between BASES and the GSK Human Performance Lab, which is part of GSK Consumer Healthcare PLC. Notwithstanding Tony Ly cholat’s concerns, we are aware that GSK has recently led the way for transparency in the Pharma and Healthcare industries, and is committed to public disclosure of all its clinical research. GSK publishes protocol summaries for all clinical trials and all raw clinical data from completed trials. The GSK Human Performance Lab is a leading research centre, supporting elite performers and conducting novel applied research. It has a broad focus across health and performance of elite performers. There is a good fit across the two organisations with their similar and complimentary objectives. We believe that BASES members may benefit from the GSK Human Performance Lab Expert Community, which is designed to give academics, applied scientists, practitioners and coaches access to their cutting-edge research and expertise in elite human performance. Sponsorship of the association’s flagship event has many benefits including assisting with keeping delegate fees affordable (and particularly the fees of BASES student members). It would be disappointing if GSK Human Performance Lab wished to be merely a silent partner in the arrangement and not wish to help design the conference programme with one representative on the Conference Scientific Programme Committee (as opposed to two, as stated in the letter). Their representative is Head of Research and Development and is also a Fellow of BASES.
Diary dates

19 Sep. BASEM Exercise in Health and Disease Course, West Midlands
22 Sep. Just Good Medicine - The role of physical activity in the prevention and management of long term conditions, Loughborough University
9-10 Oct. The Young Athlete ACPSEM Biennial Conference, Brighton
21 Oct. BASES Core SE workshop: Understanding Your Client, Chester - FULLY BOOKED
21 Oct. BASES Workshop: Movement Analysis and Biomechanics: The Application to Practice, Cardiff
29 Oct. London South Bank University Sports Conference

12-13 Nov. BASEM-FSEM Joint Annual Conference 2015, Cardiff
17-19 Nov. Food Matters Live, ExCel Centre, London
1-2 Dec. BASES Conference 2015, St George’s Park
8-9 Dec. Nutrition Society Winter Conference, Roles of Sleep and Circadian Rhythms in the origin and nutritional management of obesity and metabolic disease, Royal College of Medicine
29-30 Nov 2016, BASES Conference 2016, Nottingham’s East Midlands’s Conference Centre
28-29 Nov 2017, BASES-FEPSAC Conference 2017, Nottingham’s East Midlands’s Conference Centre

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Divisional digest

Dr Chris Harwood FBASES provides an update from the BASES Division of Psychology
c.g.harwood@lboro.ac.uk

With the new divisional structures of BASES beginning to establish ways of working to optimally support members, it is timely to be offered the opportunity to talk about progress within the Division of Psychology. First and foremost on our minds has been ensuring that sport and exercise psychology is not only well-represented at the annual conference, but that we offer invited speakers, topics and formats that genuinely attract applied researchers and practitioners. For this second (and final year) at St. George’s Park, we have an exceptional line up of speakers over the two days spearheaded by sessions from Prof Lew Hardy FBASES and a round table discussion.

In 2016 and 2017, the conference will be held at the East Midlands Conference Centre, with BASES partnering with the European Federation of Sport Psychology (FEPSAC) to jointly host the BASES-FEPSAC Conference 2017 in December. As a group member of FEPSAC, BASES submitted a successful bid to host their quadrennial conference on the basis of offering European visitors with access to cutting-edge sport and exercise science knowledge alongside contemporary work in sport and exercise psychology. With a strong divisional and FEPSAC strand throughout the conference, it will not be one to miss!

Over the last 12 months, we have also worked hard on ensuring that the Division of Psychology offers appropriate workshops and webinars. We need to look at expanding our CPD offering and Dr Zoe Knowles FBASES has been very proactive in this respect. This brings me to the important relationship with the Division of Sport and Exercise Psychology (DSEP) in the British Psychological Society (BPS). We have made efforts to work together on a number of initiatives that I believe are critical for the gold standard development and accreditation of those professionals offering services in sport and exercise psychology. With Health and Care Professions Council (HCPC) status in mind, I’m concerned that both BASES and DSEP are responsible of qualified practitioner psychologists. I believe that both organisations can play valuable roles, but a lot of work in this area - both pragmatic and political - needs careful attention. We will keep members posted on important developments but would also ask for your support and involvement in key initiatives that will arise. Please let us know if you are interested in contributing to divisional work as growing and sustaining the division is important in the coming years.

Have a fantastic Autumn in your work within sport and exercise science.

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The BASES Expert Statement on Aerobic Training for Older and Clinical Groups using Arm Crank Ergometry

Produced on behalf of the British Association of Sport and Exercise Sciences by Dr Lindsay Bottoms, Dr Paul Smith, Dr Garry Tew and Dr Mike Price FBASES.

Introduction
While lower-limb exercise is more commonly studied and prescribed than upper-body exercise, this alternative exercise mode has many important applications. This expert statement outlines the potential benefits associated with arm crank ergometry. Although not as familiar as treadmill running or cycle ergometry, most modern fitness centres offer arm crank ergometry, and commercially-available equipment is available for the domestic setting. Information contained herein presents evidence linked to the feasibility of aerobic training using arm crank ergometry for a variety of sub-populations. Further, it also provides testing and training recommendations. Although this statement focuses specifically on older and clinical groups, detailed arm crank ergometry testing guidelines for young and healthy participants are available (Smith & Price, 2007). This statement extends the reference to arm crank ergometry in the BASES expert statement, which focused on spinal cord injury populations (Goosey-Tolfrey et al., 2013).

Background and evidence
Important points regarding acute responses and chronic adaptations to arm crank ergometry include:
• In healthy individuals, peak oxygen consumption (VO₂peak) for arm crank ergometry is ~30% lower compared to lower body exercise.
• At the same absolute intensity, arm crank ergometry evokes a lower stroke volume, a higher heart rate and a greater sympathic response compared with lower-body exercise.
• It is feasible to employ constant load, submaximal efforts, all-out sprint activity or high intensity, interval training with arm crank ergometry.
• Compared to lower body exercise, arm crank ergometry is inefficient, however meaningful training adaptations can be achieved using comparatively low absolute exercise intensities.
• A cross-transfer effect of arm crank ergometry training (i.e., where fitness gains linked to arm crank ergometry result in functional improvements during lower body exercise) is evident for sedentary and clinical participants.

Applications for older and clinical populations
Clinical applications of arm crank ergometry clearly exist. Cardiopulmonary testing is useful to evaluate the physical capacity of people with lower extremity impairments caused by vascular, orthopaedic or neurological conditions. Thus, arm crank ergometry can form an integral aspect of training in sedentary, obese and older participants, as well as the clinical rehabilitation of individuals with peripheral arterial disease, chronic obstructive pulmonary disease, spinal cord injury, stroke and chronic heart failure.

Aerobic training for older participants
Few studies have investigated the effects of arm crank ergometry training in older adults. The most relevant example is that of Pogliaghi et al. (2006). They examined physiological and functional adaptations in two groups of older men during 12 weeks of training using either arm crank ergometry or leg cycling, compared to that of a control group. At baseline and following the intervention, participants performed cardiopulmonary exercise tests to exhaustion using an arm crank and cycle ergometer. Physiological responses and fitness capacity did not change in the control group; results for the training groups is summarised in Table 1.

Both training modes evoked meaningful improvements in sub-maximal and maximal measures of cardiorespiratory fitness. Mode-specific and cross-transfer adaptations were observed in both training groups; cross-transfer effects amounted to ~50% of mode-specific effects. The ‘transferability’ of training benefits has been classically interpreted as indirect evidence of a central, cardiovascular-related form of adaptation.

Aerobic training in chronic obstructive pulmonary disease
This common lung disease is characterised by airflow obstruction that is not fully reversible. Associated with breathing difficulties (dyspnoea), exercise intolerance and impaired quality of life, pulmonary rehabilitation plays an important role in the management of chronic obstructive pulmonary disease. Pulmonary rehabilitation using arm crank ergometry is recommended as part of the exercise

Table 1. Changes following 12 weeks of training in older adults (reproduced from Pogliaghi et al., 2006)

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable</th>
<th>Change on cycle ergometer test</th>
<th>Change on arm crank ergometry test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm crank ergometry training</td>
<td>Peak power (W)</td>
<td>+ 12 (8%)</td>
<td>+ 19 (22%)</td>
</tr>
<tr>
<td></td>
<td>VO₂ peak (L·min⁻¹)</td>
<td>+ 0.21 (9%)</td>
<td>+ 0.37 (23%)</td>
</tr>
<tr>
<td></td>
<td>Peak O₂pulse (mL·beat⁻¹)</td>
<td>+ 1.5 (10%)</td>
<td>+ 2.4 (22%)</td>
</tr>
<tr>
<td></td>
<td>Power at VT (W)</td>
<td>+ 5 (5%)</td>
<td>+ 10 (17%)</td>
</tr>
<tr>
<td></td>
<td>VO₂peak at VT (L·min⁻¹)</td>
<td>+ 0.09 (5%)</td>
<td>+ 0.19 (18%)</td>
</tr>
<tr>
<td>Cycle training</td>
<td>Peak power (W)</td>
<td>+ 26 (18%)</td>
<td>+ 4 (5%)</td>
</tr>
<tr>
<td></td>
<td>VO₂ peak (L·min⁻¹)</td>
<td>+ 0.39 (18%)</td>
<td>+ 0.16 (9%)</td>
</tr>
<tr>
<td></td>
<td>Peak O₂pulse (mL·beat⁻¹)</td>
<td>+ 2.4 (17%)</td>
<td>+ 1.2 (10%)</td>
</tr>
<tr>
<td></td>
<td>Power at VT (W)</td>
<td>+ 19 (19%)</td>
<td>+ 3.5 (5%)</td>
</tr>
<tr>
<td></td>
<td>VO₂peak at VT (L·min⁻¹)</td>
<td>+ 0.21 (13%)</td>
<td>+ 0.07 (6%)</td>
</tr>
</tbody>
</table>

Data are presented as absolute changes in mean values with relative changes in parentheses. Specific effects are shaded in pale red.
training regime as it has a positive impact on exercise capacity, arm strength and reduces symptoms of dyspnoea (Ries et al., 2007).

Aerobic training in peripheral arterial disease
Lower-limb peripheral arterial disease is a medical condition characterised by a narrowing of the arteries in the legs. A common symptom of peripheral arterial disease is intermittent claudication, a cramp-like leg pain that occurs while walking due to insufficient muscular blood flow. Regular walking exercise improves functional outcomes in people with intermittent claudication. However, since walking can be painful, the desire and ability of these patients to perform such activity is often limited. Three small-to-moderately sized clinical trials have demonstrated that arm crank ergometry is well-tolerated in peripheral arterial disease and, as an alternative training modality, can induce similar improvements in pain-free and maximum walking distances (Tompra et al., 2015). In contrast to moderate intensity, continuous exercise, this study employed an interval training approach of 2 min of moderate-to-hard exercise at 50-60 rev·min⁻¹, followed by 2 min of passive recovery, for duration of 40 to 60 min; training was completed 2 to 3 times per week for 12 to 24 weeks. Interval training was favoured to continuous training primarily because it allowed for a higher-intensity of exercise to be performed, thus maximising the potential for a cross-transfer effect of arm crank training to walking ability.

Testing and training recommendations
Assessing VO₂peak and peak aerobic power (Wpeak) should precede and inform all aspects of training outlined below. We recommend Wpeak should be used to accurately prescribe subsequent, relative exercise intensity as VO₂peak does not always increase in a linear fashion with power output. Ideally, all testing and training should adopt a crank rate between 70 to 80 rev·min⁻¹ where achievable however, for participants exhibiting reduced fitness slower crank rates (50 to 60 rev·min⁻¹) may be more appropriate.

Protocols for Wpeak
Protocol 1 (older populations):
5 min warm-up at 30 W
Step increases of 5 W·min⁻¹ until maximum volitional exertion (Pogliaghi et al., 2006).

Protocol 2 (clinical populations)
2 min unloaded arm cranking at 50-60 rev·mi⁻¹
Ramp of 5-15 W·mi⁻¹ until maximum volitional exertion (Janaudis-Ferreira et al., 2012).

In both examples, we recommend that test time is accurately recorded to allow the precise calculation of final minute, peak aerobic power (Wpeak).

Interval training
Ideally, approximately 10 to 20 min of ‘heavy’ exercise should be achieved using a 1:1 work-to-rest ratio. For intensities ranging between 80 to 90% Wpeak employ 5 to 10 intervals lasting 1 to 2 min. Where a slightly lower intensity range of 70 to 80% Wpeak is used, employ 5 to 10 intervals of 2 to 4 min duration.

Continuous training
Begin at a relative power 40 to 60 % Wpeak and complete a session of 20 to 40 min duration.

Conclusions
• Established testing guidelines exist for arm crank ergometry (Smith & Price, 2007)
• Arm crank ergometry has many useful training applications, many of which extend to older participants and settings of clinical rehabilitation
• It is feasible for most sub-populations of participants to engage with arm crank ergometry, which is sometimes better tolerated than other modes of lower body exercise
• The nature of training can take the form of constant load, moderate exercise, high-intensity, interval training or all-out repeated sprint activity, though evidence supporting the implementation of sprint exercise is limited.

References:

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The BASES Expert Statement on Assessment and Management of Non-asthma Related Breathing Problems in Athletes

Produced on behalf of the British Association of Sport and Exercise Sciences by Dr John Dickinson, Prof Alison McConnell FBASES, Dr Emma Ross FBASES, Dr Peter Brown and Dr James Hull.

Introduction
Exercise respiratory symptoms including wheezing, tight chest, difficulty to breathe, shortness of breath, coughing and breathlessness are commonly reported by athletes. These symptoms are non-specific and could be due to a variety of causes outlined in Table 1. It is imperative that clinical assessment and advice is sought initially to either confirm or eliminate the presence of cardio-pulmonary causes. The prevalence of asthma and exercise induced bronchoconstriction (EIB) can be up to 70% in sports with high breathing requirements, and/or sports undertaken in environments where inhaled air is dry and/or polluted. Given this high prevalence, it is tempting to assume that exercise-induced respiratory symptoms in athletes are most likely due to asthma or EIB. However, symptoms alone are misleading; Dickinson et al. (2005) reported that 21% of elite British athletes received an inappropriate diagnosis of asthma/EIB. In the majority of these cases, athletes had not undergone an objective airway challenge to confirm diagnosis before therapy was initiated. Current guidelines state that if either asthma or EIB is suspected, an athlete should undergo an airway challenge (e.g., eucapnic voluntary hyperpnoea) to confirm the diagnosis, thus reducing the potential for inappropriate diagnosis (Parsons et al., 2013).

Table 1. Potential causes of exercise induced respiratory symptoms

<table>
<thead>
<tr>
<th>Cause</th>
<th>Hyperventilation syndromes</th>
<th>Cardiopulmonary causes</th>
<th>Cardiac dysfunction</th>
<th>Anaemia</th>
<th>Pneumothorax</th>
<th>Parenchymal lung diseases</th>
<th>Pulmonary vascular disorders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise induced bronchoconstriction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of fitness</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Obesity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise induced laryngeal dysfunction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dysfunctional breathing patterns</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
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</tr>
</tbody>
</table>

It is possible that athletes’ respiratory symptoms may not be due to asthma/EIB. Further, athletes with asthma/EIB may still report exercise respiratory symptoms, despite being adequately medicated for their airway disease. The purpose of this BASES expert statement is to provide an overview of the differential diagnosis for exercise-induced respiratory symptoms and to discuss interventions that may help to manage symptoms.

Differential causes of exercise respiratory symptoms

Exercise-induced laryngeal obstruction (EILO)
It is not uncommon to encounter athletes who report troublesome exercise-associated respiratory symptoms in the absence of objective evidence of airway narrowing. It is now recognised that, in a significant proportion of these individuals, symptoms that were attributed to EIB/asthma, may actually arise from a transient exercise-induced narrowing at the level of the larynx (voice box). This phenomenon, termed exercise-induced laryngeal obstruction (EILO), manifests as dyspnoea, wheeze and cough on peak exertion and will not respond to a therapeutic strategy targeting EIB (Nielsen et al., 2013). Confirmation of EILO requires direct nasendoscopy to be performed during exercise (see Figure 1), and it should be recognised that there is a considerable overlap between EIB and EILO; i.e., some athletes will have both conditions thus rendering them ‘refractory’ to EIB treatment alone.

Dysfunction breathing
The term ‘dysfunctional breathing’ (DB) encapsulates a variety of idiopathic breathing abnormalities that have no obvious organic, pathological origin. DB may be underpinned by abnormal breathing mechanics caused by respiratory muscle dysfunction and/or reduced respiratory system compliance, as well as to anxiety and/or hyperventilation syndrome (see Table 2).

Table 2. Signs and symptoms of dysfunctional breathing during exercise

<table>
<thead>
<tr>
<th>Sign</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Bias towards chest breathing (rather than diaphragm breathing)</td>
</tr>
<tr>
<td>2.</td>
<td>Rapid, shallow breathing pattern during exercise, and possibly also at rest (breathing pattern can be regular, or irregular)</td>
</tr>
<tr>
<td>3.</td>
<td>Inability to synchronise breathing to movement cadence with a consistent rhythm</td>
</tr>
<tr>
<td>4.</td>
<td>Blunted ventilatory compensation for metabolic acidosis (supra-lactate threshold VE/VO2 ratio &lt;25 units)</td>
</tr>
<tr>
<td>5.</td>
<td>Inappropriate ventilatory distress, especially during high intensity exercise</td>
</tr>
</tbody>
</table>

In dysfunctional breathing the primary symptom is breathlessness, resulting in premature exercise intolerance. Physiologically, dysfunctional breathing can result in diametrically opposed signs at rest, compared with exercise. At rest, there may be hyperventilation and hypocapnia, whilst during exercise there may be hyperventilation and hypercapnia. An overreliance upon breathing frequency to meet ventilatory requirements (tachypnoea) leads to an inability to increase minute ventilation (VE) sufficiently to meet metabolic demand. The tachypnoeic breathing pattern, combined with an under-compensated
metabolic acidosis, leads to intense breathing discomfort. Diagnosis of dysfunctional breathing is not straightforward, but an incremental exercise challenge can reveal clear evidence of an abnormal exercise hyperpnoea. Assessment of breathing pattern and expired gases during exercise, as well as observations of breathing at rest and during exercise is therefore recommended.

Interventions for the symptomatic athlete
There is little primary research evidence to support or refute the use of these techniques in the treatment of EILO or DB. Despite this, the standards of care committee support their use in these conditions (Bott et al., 2009) and preliminary studies suggest clinical efficacy.

Breathing pattern retraining
Most individuals with EILO and/or dysfunctional breathing have inefficient breathing technique, using chest, or even clavicular breathing, which can increase laryngeal tension. Thus, retraining strategies require a degree of neuromuscular re-education to ensure that the complex inspiratory musculature is used holistically and in concert during both training and everyday life (McConnell, 2011). Thus, breathing pattern training programmes have focused on diaphragmatic breathing and respiratory control. Exercise capacity, breathlessness and quality of life have been improved by breathing training in individuals with EILO and dysfunctional breathing. The athlete, coach and practitioner must be aware of the tendency to fall back into faulty patterns during periods of stress or high ventilatory demand, and develop strategies (such as verbal cues) to adjust breathing during training or competition.

Management of acute severe exercise induced respiratory symptoms
Breathing pattern training can also be used in the management of acute episodes of non-asthma related respiratory distress. Leaning forward to take the weight of the trunk on the knees, or a table, unloads the postural activity of the trunk’s respiratory musculature, allowing the respiratory muscles to deliver ventilation. There should also be a focus upon deep, controlled, diaphragmatic breathing, as well as verbal reassurance that the symptoms will subside.

Inspiratory muscle training
Dysfunctional breathing and EILO may only be present during high intensity exercise. The use of inspiratory muscle training (IMT) and breathing pattern retraining have been shown to be effective in resolving respiratory symptoms during high intensity exercise when used holistically. It is important to ensure breathing technique is addressed initially, by focusing upon diaphragmatic breathing, rather than clavicular or chest breathing. Athletes with poor breathing technique, who proceed directly to IMT, may experience exacerbation of their symptoms. Training the inspiratory muscles is performed by breathing forcefully through a hand-held device providing resistance to the inspired airflow. During IMT, the practitioner coaching the athlete should focus upon developing good breathing technique, as well as instructing the athlete to open the ‘throat’ (larynx and upper airway) fully throughout the inhalation to ensure transferability to exercise conditions. Commercially available pressure threshold devices are considered the most economical tool (time and money) since they target the strength and endurance characteristics of the inspiratory muscles. A typical IMT session comprises 30 continuous forced inspiratory efforts at the equivalent of 30 breath repetition maximum, with relaxed expiration. The use of IMT to attenuate symptoms of dysfunctional breathing and EILO is supported by case studies in Olympic athletes (Dickinson et al., 2007).

Conclusions and recommendations
1. Athletes who report exercise-induced respiratory symptoms should have a full patient history and objective airway challenge before assuming a diagnosis of conditions such as asthma and/or EIB.
2. Initial reports suggest that breathing pattern retraining and IMT can be effective interventions to treat exercise-induced respiratory symptoms due to conditions such as EILO and dysfunctional breathing.
3. Understanding the mechanisms of EILO and dysfunctional breathing will allow methods of prevention and treatment for these conditions to be optimised.

References:

Download a PDF of this article: www.bases.org.uk/BASES-Expert-Statements
MURPHY’S LAWS OF PHYSICAL ACTIVITY AND HEALTH

Are architects and engineers putting public health at risk?

Prof Marie Murphy FBASES is the physical activity for health columnist for The Sport and Exercise Scientist.

Murphy’s Law #2 - Encourage the public to avoid escalators and moving walkways: Save them time while improving their health

For anyone who grew up watching re-runs of the Hanna-Barbera cartoon The Jetsons, moving walkways were magical futuristic machines, which would one day transform our lives moving us quickly and effortlessly from one place to the next. Together with wristwatches that made video calls, the moving walkway was part of some fictional space-age world. In fact, escalators and moving walkways, first showcased in the late 19th century as tourist attractions or novelty rides, have become an integral feature of pedestrian transport in many modern buildings including workplaces, shopping centers, airports, train stations and other public spaces. Many of the escalators and walkways we encounter on a daily basis cover modest rises and walkable distances that could be easily covered by most healthy individuals. Moreover the presence and central placement of these passive methods of moving from A to B may be depriving us of valuable opportunities to increase physical activity. Is it time to encourage the public to shun the escalator, lift and moving walkway as a viable way of promoting public health?

In recent years, when walking has become a cornerstone of physical activity promotion, the use of moving walkways appears to have increased exponentially. The purpose of these expensive human conveyor belts is to speed up journeys (e.g., from airport security to departure gate). They are designed for users to get on and continue walking to lever advantage from the additional speed provided by the walkway. However, many use these walkways by stepping on and standing still. With most walkways set to move at speeds of between 2 and 4 km.h⁻¹, well below the usual self-selected walking speed of healthy adults (5-6 km.h⁻¹; Murtagh et al., 2002) standing still on these machines is actually likely to slow the journey. Even those who use the walkway as intended are not likely to speed up their journey. Researchers at Princeton have found that people using walkways may reduce their speed in an attempt to reconcile the sensory conflict between the forward movement sensed visually and the walking speed that the legs feel (Srinivason, 2009). Indeed attempts to introduce a high-speed walkway (9-12 km.h⁻¹) in the Paris metro station Montparnasse had to be abandoned due to the number of users having accidents.

Although often overlooked, current physical activity guidelines for adults include recommendations for both vigorous intensity and muscular strengthening activity (DoH, 2011). Aside from the debate on the suitability of High Intensity Interval Training (HIT) for public health promotion (Biddle & Batterham, 2015), one of the criticisms of HIT is how it fits into daily lifestyle or the ecological validity of HIT research to date. Avoiding the escalator and taking the stairs may be a time-efficient ‘lifestyle’ approach to HIT allowing the accumulation of vigorous intensity and/or muscle strengthening activity. The health benefits of stairclimbing have been documented (Boreham et al., 2005) and the use of ‘point of decision prompts’, stairwell enhancement and motivational/directional signs have been shown to encourage stair use in short-term interventions in a range of settings (Bellicha et al., 2015). In terms of intensity, stairclimbing is likely to be vigorous intensity for most of the adult population. Although in some cases the distances and vertical rise required might justify the use of an escalator (e.g., Angel Tube station escalator is 60 m long with a vertical rise of 27.5 m) and it is unlikely many individuals will be able to accumulate stair climbing in the 10 minute bouts stipulated in the guidelines - it certainly seems plausible that by choosing to take the stairs or planning a route that incorporates some stairclimbing many could fit some vigorous intensity activity into their daily routine. For younger fitter individuals then taking the steps two at a time or even running up a flight will increase...
physiological demands. For those at a lower level of fitness or older adults with lower aerobic capacity using the handrail, climbing at a slower pace or even just walking downstairs is likely to be vigorous intensity and encourage the development or maintenance of muscle function.

With increasing recognition of environmental influences on physical activity maybe it’s time for those designing buildings to consider the design and placement of escalators and walkways within our public buildings using ‘choice architecture’ or altering the micro-environment in order to change population health behaviour (Hollands et al., 2013). By placing stairs and non-motorised walkways in the most, not least conspicuous places perhaps they can ‘nudge’ greater proportions of the population to make a physically active choice.

“...The other people I hate are the people that get on to the moving walkway and then just stand there. Like it’s a ride? Excuse me, there’s no animated pirates or bears along the way here. Do your legs work at all?”

Jerry Sienfeld (1992) Episode 41 The Trip

As physical activity advocates perhaps we should advise people to take a different approach so that next time they see a moving walkway or escalator, they stay clear but try to keep pace with those who have made the less active choice. Not only are they likely to get to where they need to be quicker - the brisk walk or climb will have helped them accumulate some more of the recommended 150 minutes of moderate or 75 minutes of vigorous intensity activity.
Practical guidelines for using inventories in sport psychology

Profs Tom Brinthaupt and Mark Anshel share their thoughts on the proper use of psychological inventories.

Sport and exercise psychologists are familiar with the need to use inventories with acceptable psychometric properties. However, adhering to proper measurement guidelines in research, consulting, and practice can be a challenge. Measures are easy to find, but they may not include information about their development and validation. Improper use of psychological inventories can lead to inaccurate or incomplete interpretations of data or diagnoses, which can compromise the effectiveness of intervention efforts.

Important psychometric properties
At the most general level, we want to ensure that any measures we use have been ‘validated’. This typically includes evidence that the measure is reliable (i.e., it measures the same thing in a consistent fashion or the measure’s items address the same underlying construct) and valid (i.e., it accurately measures what it is supposed to measure). It is also important that a measure’s administration and scoring are standardised and that we follow those procedures when using it. It is a mistake to find a measure and administer it with our own instructions rather than using the procedures that are provided by the measure’s developer, since doing so might have negative effects on the measures reliability and validity.

Common errors when using psychological inventories
There are several ways that psychological inventories can be used improperly. Using self-created inventories that have not been subjected to psychometric scrutiny prevents the confident drawing of conclusions. An inventory may have been developed for a research, descriptive, or diagnostic purpose, and using it for a different purpose may not be justified. A common problem is that an inventory may not have been developed with sport or exercise settings in mind. In addition, researchers or consultants might conduct interventions that are focused on personal

<table>
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<th>Table 2. Best practice recommendations for the use of psychological inventories</th>
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<td><strong>Prior to administration</strong></td>
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<td>1 Identify the inventory’s purpose and its psychometric properties</td>
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<td>2 Determine the objectives and conceptual framework for your inventory use</td>
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<td>3 Determine how your inventory data will be used to demonstrate consultation effectiveness</td>
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<tr>
<td>4 Obtain written consent and Institutional Review Board (IRB) approval (if applicable).</td>
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<tr>
<td><strong>During and after administration</strong></td>
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<tr>
<td>5 Establish trust between the consultant and athlete</td>
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<td>6 Take account of group and cultural differences</td>
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<td>7 Determine client reading level</td>
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<tr>
<td>8 Obtain client confirmation or refutation of inventory scores</td>
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<td>9 Ensure data accuracy</td>
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<td>10 Interpret scores with norms</td>
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<td>11 Document the experience of using the inventory.</td>
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characteristics (such as personality traits) that are not susceptible to change. Whether the inventory is appropriate to use in these settings is an empirical question. Whenever a measure is used outside of the context of its original development, researchers or consultants should collect and report the measure’s psychometric properties within the alternative context.

We list some of the most common errors with inventory use in Table 1. As this table shows, the potential is great that improperly using inventories can lead to inaccurate impressions, erroneous perceptions and expectations, and incorrect judgments. All of these errors have the potential to negatively impact the psychometric properties of a measure.

Best practice recommendations for using psychological inventories

We provide a list of best practice recommendations in Table 2. As this table shows, effective inventory use involves matching the purposes and range of application of the inventory with the goals of one’s research or consulting project. Such matching may not always be possible. For example, there may not be an existing measure that fits well with your objectives. In such cases, judgment calls and flexibility may be necessary, which in turn could threaten the soundness of one’s project and the legitimacy of one’s conclusions.

Summary and conclusions

On the surface, the use of psychological inventories is not a difficult or complicated venture. However, we have demonstrated that, to maximise the effectiveness of such inventories, there are several concerns to be addressed and strategies and guidelines to be applied. Making your use of inventories more complicated, in these ways has multiple benefits, including providing empirical evidence of the adequacy of the measures used and providing new data for the further validation of the inventory. Perhaps most importantly, following best practice recommendations such as these can help move the field forward. Becoming mindful of the potential limitations of a psychological inventory should be a prerequisite to using it.
Reviews - apps and books

Motor Learning and Performance - A Situation-Based Learning Approach
Human Kinetics
Hardback £20.28
Rating 9/10

A very interesting and informative read. This book is split into four sections and is set out in a way that allows readers to develop their learning. In addition to the text the ‘what is relevant?’ boxes discuss points in history that relate to the text and the ‘it depends’ boxes provide examples to check your learning from everyday life and not just sport. There are small boxes of definitions highlighting key points from the text along with clear images. Each chapter ends with a section entitled ‘from principles to practice’ helping to reinforce the key messages. The case studies included in the penultimate chapter aids your understanding and the final chapter helps to put the learning into practice for you. A useful text for both students and practitioners who are developing their learning and a useful reference tool for established practitioners. The book comes with access to an online study guide resource. I would highly recommend this book to all interested in sport as it has helped to develop my understanding of motor learning and performance.

GORDON ROBERTSON, ROBERTSON ELITE TRAINING/ GEORGE HERIOT’S SCHOOL
Rating 9/10

Foundations of Sport and Exercise Psychology
Human Kinetics
Hardback £71; Kindle version £28
Rating 9/10

Since 1995 Weinberg and Gould’s Foundations of Sport and Exercise Psychology has been the ‘go to’ introductory text. The 6th Edition suggests that this is set to continue. There are updates in several areas; for example there is greater density of post 2012 references in sections covering physical activity and exercise behaviours. Another area of development is the teaching materials supporting the text. The web study guide accompanying the book allows access to a vast array of video, PowerPoint slides, interviews with practitioners and test banks. The text doesn’t quite teach your students for you but it certainly provides the resources to support introductory level courses very comprehensively. Are there any negatives? Yes a couple of quibbles, first, despite efforts to internationalise the content there is still, for me, too much grid iron and baseball, and too little cricket and rugby. The other quibble is related to the lack of a methods chapter. It would make both the teaching of research methods and critical thinking skills easier if a main text were to acknowledge more explicitly that methodology is at the cornerstone of knowledge construction. It’s a problem not unique to this text. Despite this, it’s an excellent textbook!

DR TONY WESTBURY, EDINBURGH NAPIER UNIVERSITY
Rating 9/10

Europe Active’s Foundations for Exercise Professionals - Core Knowledge for All EQF Levels
Human Kinetics
Hardback £32.99
Rating 8.5/10

This book truly lives up to its title by providing a foundational overview of all areas of physical training and exercise. Topics are covered in simple to follow sections with diagrams and charts used extensively to keep messages clear and concise, giving a clear visual representation of the text. The book is marketed as applicable for all levels, however, many more experienced practitioners may see the content as basic, and lacking in detail of more in-depth and complex processes of the body. Often the content can be seen as similar to 1st year undergraduate level, and because of this the ideal reader would be those starting out in the health and exercise industry, or those with knowledge in a single sector looking for a knowledge base across a wider spectrum. Text is well referenced with both classic texts and recent publications. In terms of applications, the training prescriptions are basic and cover all categories of training, however, it should be noted that many of the training techniques are aimed at recreational exercisers interested in a health and wellness perspective, rather than those of athletes. In summary, this book is the ideal starting point for the exercise professional.

NICK ADKIN, ASTON VILLA FOOTBALL CLUB
Rating 8/10

App Name: Edufii.com
App Developer: Spencer Dennis
App Cost: Free
Download at: Apple App store and Google Play
Devices: Computer, tablet, smartphone apple and android

I have been using the eduﬁi.com app and its training spaces for 10 months now. I have recommended it to others to use as it is very good for coaches, sport scientists and athletes alike to communicate and collaborate with each other in a private space. It is also provides a way for high performance teams and sport organisations to oversee their athletes. The platform allows athletes to debrief after competing or training allowing their chosen support team members to remind, challenge and encourage them. The push posts allow you to respond immediately. Unfortunately the user friendly Facebook style feed page lacks a ‘like’ button, which would be useful to letting the athlete/poster know you’ve read the post when a comment isn’t necessary and it lacks the ability to edit posts once posted, frustrating when you hit post before editing. The developers are receptive to feedback but seem slow to implement changes. Useful for teams and beginner athletes, the ability to upload video clips (along with photos) of athlete performance and training sessions can remind athletes of what they are focusing on enabling them to have their learnings reinforced. Overall, a highly recommended unique and useful app.

VICKI AITKEN, NORTHERN TERRITORY INSTITUTE OF SPORT, AUSTRALIA
Rating 8.5/10

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EuropeActive’s Foundations for Exercise Professionals provides core knowledge and industry standards to help exercise professionals serve their clients. Endorsed by EuropeActive, the continent’s leading standard-setting organisation in fitness and health, this text is an authoritative guide for current and future exercise professionals and training providers in Europe.

EuropeActive’s Essentials for Fitness Instructors contains the most comprehensive information and materials to guide fitness instructors towards best practices in helping clients achieve their fitness and health goals. Endorsed by EuropeActive, the fitness and health industry’s standard-setting authority in Europe, this manual is essential for all aspiring and qualified fitness instructors.

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## DAY 1 - TUESDAY 1 DECEMBER 2015

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<th>Time</th>
<th>Event</th>
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<td>07.30-08.45</td>
<td>Exhibitor set up</td>
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<td>09.00</td>
<td>Registration and drinks</td>
<td>Conference Hub</td>
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<tr>
<td>10.10</td>
<td>Opening address - Prof Ian Campbell, Chair of BASES</td>
<td>Sir Bobby Robson</td>
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| 10.20-11.20   | Invited keynote: Sport England's journey from sport development to behavioural change  
Jennie Price, Sport England  •  Chair: Prof Mary Nevill  
This session will focus on Sport England’s innovative approaches to growing participation, using insight to inform its actions and encourage behaviour change. It will feature the ‘This Girl Can’ campaign, celebrating active women up and down the country who are doing their thing regardless of ability, appearance or judgement. | D1.S1.  
Sir Bobby Robson |
| 11.20-11.40   | Exhibition and refreshment break                                     | Conference Hub           |
| 11.40-12.55   | Parallel invited symposia                                           | Conference Hub           |
| 12.55-14.00   | Lunch, networking, exhibition and posters                            | Conference Hub           |
| 14.00-15.30   | Parallel free communication sessions                                 | D1.S3.                   |
| 15.30-15.50   | Exhibition and refreshment break                                     | Conference Hub           |
| 15.50-17.05   | Parallel invited symposia                                           | Conference Hub           |

### Ready for Rio 2016! FUSION of evidence-based practice and practice-based evidence to support Olympic and Paralympic athletes  
Dr Emma Ross FBAS and Liz Sinton  
•  Chairs: Stafford Murray and Dr Peter Brown  
Supported by GSK Human Performance Lab  
The aim of this session is to demonstrate how in elite sport science support, delivery of the trade is a carefully crafted fusion between scientific knowledge and experience at the coal face. There will be an explanation of the planning of the applied practitioner’s journey throughout the Olympic and Paralympic cycle with detailed practitioner insight of applied sport science FUSION.  

### Cutting edge approaches to behaviour change  
Prof Susan Michie and Dr Panteleimon Ekkekakis  
•  Chair: Prof Nanette Mutrie MBE, FBAS  
Prof Susan Michie will present a method for designing effective interventions, starting with a ‘diagnosis’ of the target behaviour in context using a model of behaviour, COM-B. This links to a framework for developing and evaluating interventions, the Behaviour Change Wheel, which comprises nine intervention functions and seven policy categories. Dr Panteleimon Ekkekakis will (a) highlight the need to consider pleasure as the third pillar of exercise prescriptions, besides effectiveness and safety, (b) summarise current evidence on the relationships between intensity, pleasure and adherence and (c) present ways in which exercise sessions can be restructured with the goal of promoting pleasure, based on behavioural-economic principles.  

### Physiological and nutritional aspects of bone health: Implications for physical training  
Dr Craig Sale and Dr Julie Greeves  
•  Chair: Prof Lars McNaughton FBAS  
This session brings together evidence from collaborative work on the effects of exercise and nutrition on bone health, applied to athletic and military populations. The opening presentation will address the physiological responses of bone to arduous training, followed by the application of nutritional interventions to modulate bone turnover with exercise.  

### Sport psychology - round table discussion  
Brendan Copley FBAS, Dr Andrea Faull, Dr Kate Hays and Dr Stephen D. Mellalieu  
•  Chair: Dr Rich Neil  
In this session prominent practitioners offering psychological support in sport will discuss their views on contemporary themes, informed by delegates. If you have any topics or issues that you would like the panel to consider then please contact Dr Rich Neil - mell@cardiffmet.ac.uk  

### Ready for Rio - a biomechanical perspective  
Dr Jon Wheat and Dr Paul Barratt  
•  Chair: Dr Paul Worsfold  
This session will discuss how biomechanics is being utilised to assess and enhance the performance of our Olympic athletics. Experts will discuss how scientific theory and contemporary innovative methods and technologies are being implemented in the applied world and the challenges that this brings.
Parallel invited symposia

Getting published - an insider’s point of view
Prof Alan Nevill and Jonathan Manley
• Chair: Prof Clyde Williams OBE, FBASES

Sponsored by the Journal of Sport Sciences
The talk will provide researchers with tips to help get their work published. The talk will go on to provide some suggestions as to how to maximise their work’s impact once accepted. Finally, I will encourage all researchers to help contribute to the peer review process by helping with reviewing and eventually becoming members of the Journal’s Editorial Board.

Some reflections on the Research Excellence Framework 2014
Prof Lew Hardy FBASES
• Chair: Dr Keith Tolfrey FBASES

This presentation will provide a brief overview of how REF 2014 worked in practice, followed by some personal reflections about how researchers and units of assessments can best present their research for REF purposes.

Training load management during periods of intensive conditioning
Dr Carl Wells
• Chair: tbc

The sport science team at St. George's Park have gained considerable experience and knowledge of providing support within elite football, from the National squads to professional clubs and academies. A key component of the sport science support is the effective and structured management of training load, specifically during periods of intensive conditioning where the aim is to accelerate improvements in physical condition for gains in performance.


AGM
Graham Taylor Room

Gala drinks reception
Conference Hub

Conference dinner
Sir Bobby Robson Ballroom


The demands of elite Rugby Union: Player development and player wellbeing
Dr Scott Drawer and Dr Keith Stokes
• Chair: Dr Paul Worsfold

This session will cover the landscape in which players develop to become elite performers and identify processes designed to maximise opportunities for development. The physical demands of elite rugby will also be discussed in the context of how training and playing load influences injury risk/ player availability, with evidence from the men’s and women’s game.

Exercise programmes for cancer survivors: Putting evidence into practice
Prof Kerry Courneyea and Dr Anna Campbell
• Chair: Prof John Saxton FBASES

An expanding body of research supports the positive health effects of exercise in cancer survivors. This session will provide a concise overview of the field, before considering a framework for research and key research questions for the future. It will also explore practical considerations for exercise programme design and implementation.

D2.S1.1. Sir Bobby Robson 1  D2.S1.2. Sir Bobby Robson 3

Exhibition and refreshment break

Parallel free communication sessions
D2.S2.

Lunch, networking, exhibitions and posters
D2.S3. Sir Bobby Robson

Invited keynote: Bad science - Dr Ben Goldacre • Chair: Dr Jason Gill FBASES

How science, evidence and statistics can be twisted, rigged, distorted, hidden and ignored.

Closing address and award ceremony - Prof Ian Campbell, Chair of BASES
Sir Bobby Robson

Parallel invited symposia

Carbohydrate requirements for athletes: From laboratory to practice and back again!
Dr Graeme L. Close FBASES and Dr James Morton
• Chair: Dr Kevin Currell

Recent research has suggested that high carbohydrate availability during training may be counter-productive for training adaptations. Additionally, our work from applied practice has also revealed unique insights into the carbohydrate intakes of elite athletes in real-world settings. We will review our latest thinking on the carbohydrate requirements of athletes whilst suggesting that although research informs practice, practice should also inform research.

Everything is good for you if it doesn’t kill you: Some different perspectives on mental toughness in high performance settings
Prof Lew Hardy FBASES
• Chair: Dr Rich Neil

This presentation will present evidence from research across a number of domains that speaks to a neuropsychological model of mental toughness in which negative events play a central role. Parallels will be drawn with the past traumatic growth literature.

Relevant foot and ankle biomechanics: Art, science or both?
Prof Rami J Abboud
• Chair: Adam Hawkey

In this lecture, I will present some cases that we have assessed at Institute of Motion Analysis & Research at the University of Dundee that without the extensive plethora of equipment that we have, we would not have been able to inform the clinical decision.

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Webcast: Bone Health in Athletes – Exploring the Relationship Between Bone Health and Performance
Dr Ken van Someren, Head of R&D at the GSK Human Performance Lab leads a fascinating discussion with Dr Craig Sale from Nottingham Trent University, Dr Charles Pedlar from St Mary’s University, Double Olympic Gold Medalist Dame Kelly Holmes and Ana Anton-Solanas, Dietitian at the GSK Human Performance Lab, exploring both the literature and applied insights in this area.

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The case for movement screening - the usefulness depends on the application

Robert McCunn shares his thoughts on movement screening.

Introduction
Preparing athletes for competition often involves some form of assessment, especially during the preseason period in sports such as association football. In team sports, especially where staff resources are limited, an important consideration is choosing protocols that are time efficient, cost effective and have a positive impact upon the coaching process. Coutts (2014) published a short editorial that referred to ‘Occam’s Razor’, which summed up an appealing approach to applied practice: ‘more things should not be used than are necessary.’

Movement screening and injury prediction
McCall et al. (2014) surveyed 44 top-division football clubs worldwide and reported that 82% use some form of movement screening. This type of assessment is largely a subjective process that aims to measure the ‘quality’ of a movement pattern. This typically involves watching an athlete perform an exercise before assessing them against predefined criteria. Criteria are often perceived ‘errors’ in technique such as loss of balance, partial range of motion or use of compensatory movements. One of the key concepts underpinning the practice of movement screening is that athletes displaying ‘poor’ movement quality are predisposed to injury. In applying this theory to practice it is often suggested that individuals highlighted as ‘at risk’ receive specific training interventions to improve their movement competence.

At face value, movement screening represents a cost effective and time efficient practice, however, no test is perfect and it is important to remember that error exists in all protocols. For example, let’s say we are screening for a type of injury with an incidence of 1 in 100 using a test with both a sensitivity (true positive rate) and specificity (true negative rate) of 0.99 (which would be exceptionally good). Of all the individuals classified as positive (at risk), half of them would be false positives (wouldn’t suffer the injury). If one of the goals of screening athletes is to aid in the efficient allocation of limited resources then we may begin to question the usefulness of this hypothetical test given that we would have developed interventions for twice as many athletes as necessary. In the real world it is unlikely we would have access to a screening tool with such a high sensitivity and specificity meaning there would likely be false negatives (individuals who screened negative but still suffered the injury). Given the prognostic value of movement screens is poor, their use in identifying those at greater risk of injury is debatable.

Other uses and practical recommendations
Despite the potential for false positives (and negatives) movement screening can be useful in other ways. Administering the assessment regularly and in a reproducible manner may help practitioners identify movement deficiencies and develop appropriate interventions to address the issues. Additionally, this type of screening can be useful for practitioners who are faced with a squad of players they are unfamiliar with for whom they are required to provide strength training programmes (e.g., at the start of a new season) as it provides immediate information relating to the selection of appropriate exercises. The issue of whether movement screening is time efficient depends on how many exercises are chosen and how detailed the scoring criteria are. A number of established screens exist within the literature, the most researched being the Functional Movement Screen™. Despite this, for a variety of reasons, practitioners within the sport of association football often use adapted or bespoke screening protocols (McCall et al., 2014). If practitioners choose to utilise their own assessment then they should strive to include movements that reveal information related to desirable skills and be able to provide a sound rationale for their inclusion. Some examples of desirable skills for footballers might be: ability to resist trunk rotation and to land safely on one leg. When deciding what movements to include one should focus more on the attributes they are trying to evaluate as opposed to the specific exercises. A battery of just five exercises that takes two minutes per exercise to administer equates to 10 minutes per player. In a squad of 20 players this would mean a time commitment of over 3 hours, assuming the scoring is conducted in real-time. Practitioners should spend time considering the logistics during the planning phase.

Summary
• The value of movement screening currently lies in training prescription rather than injury prediction
• It can be an effective way of guiding strength training in groups of players that a practitioner is not familiar with
• If designing a bespoke movement screen then practitioners should give consideration to the issue of intra- and inter-rater reliability
• Be aware of the cost-benefit ratio and evaluate whether the proposed assessment is worth the time and produces actionable information.

References:


Controlling blood glucose around exercise in type 1 diabetes

Dr Richard Bracken, Dr Daniel Turner, Dr Matthew Campbell and Dr Daniel West provide an update.

Introduction

Regular exercise is important in blood glucose management in people with type 1 diabetes but many individuals fail to reach UK physical activity minimum guidelines (Department of Health Chief Medical Officers Report, 2011). A fear of losing control of blood glucose around exercise, exacerbated by the lack of appreciation of how different forms of exercise have a different physiological impact often leaves patients with poor confidence to manage blood glucose concentrations.

Type 1 diabetes is an autoimmune condition characterised by insufficient pancreatic β-cell insulin secretion. Although diagnosis is usually made early in life, the individual is dependent upon exogenous insulin therapy and blood glucose monitoring for the remainder of their life. In the UK, over 250,000 people have this condition (and this number is rising), at a cost to the National Health Service of approximately £1.8+ billion a year (UK National Diabetes Audit 2011-12). Avoidance of hypoglycaemia and hyperglycaemia remains an important aspect of blood glucose management strategies of the exercising patient. Individuals experience an average of two episodes of symptomatic hypoglycaemia per week and a severe hypoglycaemic incident once a year (Cryer et al., 2003).

Physical activity has great health benefits and understanding how to overcome glycaemic barriers has been the underlying drive for the research teams at Swansea and Newcastle. In people without diabetes, inhibition of pancreatic -cell insulin release occurs during physical activity at a time when skeletal muscle mechanisms orchestrate increased circulatory glucose uptake. Moreover, increased circulating insulin levels occur when carbohydrate- or protein-rich foodstuffs are ingested. Unfortunately, people with type 1 diabetes do not have autonomic insulin suppression during exercise so there remains a relatively high peripheral insulin concentration placing the person with type 1 diabetes at risk of a high tissue glucose uptake rate and risk of hypoglycaemia.

The characteristics of exercise namely, intensity, duration and mode evoke different glucose-regulatory responses dependent on the relationship of factors pushing and pulling circulating blood glucose (see Figure 1) and consequently, the certainty of managing blood glucose responses in the type 1 diabetes patient. Research studies have explored adjustments to diet and medication that improve the acute glycaemic responses to physical activity. These changes form the basis of an individualised ‘acute exercise management strategy’ that instils more confidence for patients and their healthcare providers to engage in physical activity and obtain the many physiological, metabolic and psychological health benefits of being physically active. On the assumption that patients have been assessed by their healthcare providers to engage in physical activity and obtain the many physiological, metabolic and psychological health benefits of being physically active. On the assumption that patients have been assessed by healthcare providers and present minimal complications that precludes them from starting physical activity in accordance with UK Department of Health Guidelines, a patient with type 1 diabetes may make individualised adjustments to insulin and/or carbohydrate intake before, during and/or after a bout of exercise (e.g., see Figure 2).

Insulin and carbohydrate adjustments for aerobic exercise

The administration of exogenous insulin is an essential component in the treatment of type 1 diabetes. The aim of insulin therapy is to mimic the natural secretory pattern of endogenous insulin of healthy individuals without diabetes, and maintain glycaemia within a normal physiological range (4-7 mmol.l⁻¹). Many affected individuals are either on a continuous subcutaneous insulin pump or a daily basal-bolus routine and if on a basal-bolus routine take two types of insulin; basal (slow-acting) insulin once or bi-daily and bolus (rapid-acting) insulin around mealtimes.

• Safe blood glucose ranges around exercise

According to guidelines from the International Diabetes Federation, immediate pre-exercise blood glucose should be >6 mmol.l⁻¹, but if levels are >14 mmol.l⁻¹, and in the presence of raised blood ketones, exercise should be delayed until blood glucose values decline and ketones dissipate (usually achieved through insulin administration). In addition to an immediate pre-exercise sample a
60 minute pre-exercise blood sample may provide more confidence in the direction of blood glucose concentrations before exercise.

• **Basal-Bolus insulin reduction**
  Although the majority of patients’ basal insulins are not normally adjusted, recent research demonstrate protection against nocturnal hypoglycaemia when basal insulin is reduced during the day of exercise (Campbell et al., 2015). In the literature reductions to pre-exercise rapid-acting (bolus) insulin have ranged from 10-90% (for review see Bracken et al., 2012), a range in part due to the different insulins utilised in research studies. However, a 50% reduction in rapid-acting insulin made 30-60 minutes before beginning physical activity seems prudent (West et al., 2011); a strategy that comes with no extra calorie intake.

• **Carbohydrate ingestion**
  A reduction in the amount of rapid-acting insulin is usually made alongside consumption of carbohydrate for aerobic activity. Carbohydrates come in different types. Some enter the blood stream rapidly (high glycaemic index e.g. glucose, maltodextrin) and are important in quickly alleviating hypoglycaemia whereas other carbohydrates are digested slower, (low glycaemic index; e.g. fructose, isomaltulose) and have been shown to reduce glycaemic fluctuations without detriment to exercise performance in type 1 diabetes (West et al., 2011, Bracken et al., 2012). Current recommendations suggest ingesting an upper limit of 1 g carbohydrate per kg body mass per planned hour of exercise in a 6-10% solution (see Figure 2). As an example, an 80 kg male wishing to perform 30 minutes of aerobic cycling might consume a 10% low glycaemic index solution (0.40 litres) that delivers 40 g available carbohydrate. After initial blood glucose monitoring, further adjustments of ingested amount of carbohydrates may be needed if persistent hyperglycaemia occurs.

• **Timing**
  A combined insulin reduction and carbohydrate feeding strategy 30-60 min before running can preserve blood glucose concentrations after exercise in individuals with type 1 diabetes (West et al., 2011).
  Following exercise there is a need to adjust insulin and carbohydrate to account for increased tissue sensitivity and increased rate of muscle and liver glucose uptake. Therefore, in addition to pre-exercise adjustments, consumption of a low glycaemic index carbohydrate-rich meal and a 50% decreased post-exercise rapid-acting insulin dose one hour after exercise reduces glycaemic fluctuations, inflammatory markers and protects patients against hypoglycaemia for up to 8 hours (Campbell et al., 2014).

**Insulin and carbohydrate adjustments for strength exercise**

There is less information available on the adjustments necessary for patients performing strength exercise. In contrast to aerobic exercise, strength exercise can cause large counter-regulatory hormone (catecholamines and growth hormone) responses that increase blood glucose concentrations to hyperglycaemic levels. The amount of weight lifted in a session can determine the degree of hyperglycaemia and (for morning exercise at least), there is minimal need to consume carbohydrates for strength exercise lasting ~15 to 30 minutes. Beyond this duration the increase in muscle glucose uptake tempers the exercise-induced hyperglycaemia (Turner et al., 2014). Moreover, if exercise-induced hyperglycaemia occurs research from our laboratory demonstrate a beneficial effect of delivering a small rapid-acting insulin dose immediately after exercise to decrease glucose to euglycaemic levels.

**Conclusion**

Regular exercise is a cornerstone of good glycaemic management in type 1 diabetes, yet much work remains to be done to promote physical activity, diet and medication equally. We need to instil more confidence in patients and clinical staff to manage blood glucose around exercise that allows patients to obtain the many health benefits from being active. Every patient response to exercise may differ in magnitude but it is hoped that knowledge of the typical glycaemic response to many sports and activities might help patients develop their own individualised ‘acute exercise management strategy’.

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Dr Daniel West
Daniel is a Senior Lecturer in clinical exercise physiology & nutrition at Northumbria University. He is interested in type 1 and 2 diabetes: exercise, nutrition and metabolism.

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**References:**


Campbell, M.D. et al. (2014). A Low-Glycemic Index Meal and Bedtime Snack Prevents Postprandial Hyperglycaemia and Associated Risks in Inflammatory Markers, Providing Protection From Early but not Late Nocturnal Hypoglycaemia Following Evening Exercise in Type 1 Diabetes. Diabetes Care, 37(7), 1845-1853.


The intervention is possibly beneficial (and most unlikely harmful)

Profs Will Hopkins FACSM FECSS and Alan Batterham FACSM FRSS discuss magnitude-based inference and null-hypothesis significance testing.

An outcome with magnitude-based inference (MBI)
You’ve done the study, and the title of this article is the conclusion, using our approach to magnitude-based inference (MBI; Batterham & Hopkins, 2006; Hopkins et al., 2009). Of course you will submit the study for publication, and you will expect your athletes, patients or clients to make use of the intervention, if it’s not too expensive. OK, it’s only possibly beneficial, but it’s not going to harm them², so what have they got to lose? You or other researchers can do more studies of the intervention, and someone will eventually do a meta-analysis to reduce the uncertainty in the pooled mean effect.

Outcomes with null-hypothesis significance testing (NHST)
But wait. Your effect is not statistically significant (p>0.05). Now what? Do you want to change the conclusion? To what, there is no effect? Sorry, that’s simply not true. If there is a good chance of benefit, it’s absurd and unethical to claim there is no effect. And what about publishing the study? You’ll have a hard time, if the reviewers are committed to null-hypothesis significance testing (NHST). The usual attitude of such reviewers is significant = real = publishable, and non-significant = no effect = not publishable, unless the sample size is right. That’s the way NHST is meant to be used, and it works, sort-of. Amongst other problems with NHST, the right sample size is the one that gives statistical significance 80-90% of the time (the power of the study) for the smallest important beneficial effect, and for most studies in exercise and sport science it is impractically large. For example, with 80% power and 5% significance, a controlled trial of the effect of training with a new antioxidant on competitive endurance performance would need 350 competitive athletes in each group, and if you were looking at the effects of an injury-prevention programme on risk of injury, you would need at least 2,900 athletes in each group³. So if the reviewers are doing their job according to the precepts of NHST, your study and all other underpowered studies will not get into print with non-significant effects. Occasionally though, thanks to sampling variation, researchers doing underpowered studies fluke unrealistic big effects that turn out to be significant, and these studies do get published. Hence one of the main reasons we have publication bias: significant effects are inevitably bigger than non-significant effects.

MBI vs NHST
Underpowered studies also occur in MBI, where the equivalent of non-significant is unclear, meaning too much uncertainty. But unclear effects are much less frequent than non-significant effects, so researchers using MBI get more of their studies published. What’s more, publication bias with MBI is negligible. Altogether it’s a no-brainer: MBI is superior to NHST. Unfortunately two traditional statisticians have recently tried to discredit MBI (Welsh & Knight, 2015). According to them, you can’t say an effect is possibly beneficial unless you do a Bayesian analysis. MBI is actually a form of Bayesian analysis, but when we provided them with the published evidence (Batterham & Hopkins, 2015), they simply denied it. Their other main claim is that the Type-I error rate with MBI is unacceptable high in underpowered studies. A Type-I error occurs when a trivial true effect is declared substantial. In their analysis of non-clinical MBI, any overlap of a confidence interval with substantial values incurs a Type-I error for a null true effect, so they got rates of ~60%. In our analysis, a Type-I error occurs only when the confidence interval does not overlap trivial values, so the rate is at most 5%⁴. In simpler terms, if the true effect is trivial, you make a Type-I error in MBI only if you conclude that the effect is very unlikely to be trivial. Welsh’s response (personal communication) is simply to deny our definition of a Type-I error. Stay tuned, and don’t start putting p values back into your manuscripts just yet.

References:
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Player load monitoring from accelerometry in team sports: Is it time to take one step backwards to move two steps forward?

Niels Nedergaard, Dr Mark Robinson, Dr Jos Vanreenterghem and Prof Barry Drust reflect on the current and potential future use of accelerometry for player load monitoring in professional team sport.

Background
Accelerometers have now become a desirable gadget on an endless list of tools used in the field to enhance athletes’ performance and minimise the risk of injuries (Boyd et al., 2011). This was aided by the introduction of commercial global positioning system (GPS) devices with integrated inertial measurement units (accelerometer, gyroscope and magnetometer) within the last decade in some professional team sports. Whereas most scientists and practitioners can relate to the positioning data extracted from the GPS (position, distance or speed) the interpretation of accelerometer data is not as straightforward. GPS data comes with limitations though and researchers have therefore shifted their focus to data from the inertial measurement units, and in particularly to the accelerometer data. With a higher sampling frequency (100 Hz compared to 5/10 Hz), the ability to measure three-dimensional data (compared to two-dimensional GPS data), and the potential for using it indoors, the accelerometer is believed to have more options to differentiate between the physical and/or impact demands associated with high intensity movements. But does it really?

What does the accelerometer measure?
Triaxial accelerometers are highly responsive motion sensors typically used to measure the frequency and magnitude of movements in space, as is common practice in physical activity monitoring (Yang & Hsu, 2010). When the sensor is moved, the acceleration of a mass within the unit deforms a piezoelectric sensing element to which the mass is attached. This sensing element causes an output voltage proportional to the applied acceleration. Interestingly, when an accelerometer is placed static on a levelled surface, the constant gravitational acceleration on earth causes the mass to compress the sensing element in the vertical sensing axis with a magnitude of 9.81 m/s², often referred to as 1 g.

On the sporting field the commercial GPS devices are worn on the upper part of the back inside a small pocket of an elastic vest. As such, the accelerometer embedded in the unit can estimate the accelerations of the athletes’ upper trunk. These are a consequence mainly of the forces which the athlete generates against the ground (ground reaction forces) during every foot-ground-contact, but can also stem from collisions with opponents. At 100 samples per second the accelerometer spits out a very large amount of data during every training session (see Figure 1). To help manage this volume of data, the manufacturers of the commercial devices have developed a cumulative outcome measure representing the accumulated external accelerations to which an athlete is exposed during a training session (e.g., PlayerLoad™ from Catapult Innovations). This outcome measure indicates how much the athletes movements have ‘shaken up’ the body, and it has become an accepted indicator of training load. Logically one then wonders how this new measure relates to other training load indicators, and so it has recently been shown to be moderately correlated with distance covered (Polglaze et al., 2015), VO₂ and heart rate (Barrett et al., 2014), and markers of neuromuscular fatigue (Cormack et al., 2013). Interestingly though, these alternative indicators all represent metabolic cost of the activities, and the inquisitive scientist will wonder why the amount of ‘shaking up’ the body should at all be expected to relate to metabolic cost. So is it perhaps time to take a step backwards first by reconsidering what exactly it is that we can find out from these motion sensors?

What about the body’s shock absorbers?
The metabolic cost, which is the work-energy relationship from athletes moving around the field, has been extensively studied and can be monitored using online gas analysis and heart rate in addition to GPS position tracking. GPS data can monitor the external work generated by the athlete and the associated energy demands. In other words, it monitors fuel consumption based on the athletes’ velocity and distance travelled. This can help scientists and practitioners to make sure the athlete is able to cope with the energetic demands, that is, foresee timely refuelling. Keeping the car analogy, the athlete’s so-called soft tissues (bones, cartilage, muscles, tendons and ligaments) work as shock absorbers for the
that lead to chronic or acute failure. As such, monitoring metabolic cost and monitoring cumulative mechanical stresses can be seen as two separate dashboard dials that will put sport scientists and practitioners in a stronger position to improve performance whilst also reducing the risk of injury.

**Summary**

- Time, distance covered and speed are measures from GPS sensors that allow monitoring of the external work to represent internal energy demands, that is, metabolic load.

- Accelerations from accelerometers can allow monitoring of the external forces on the body to represent mechanical stresses to soft tissues (bones, cartilage, muscles, tendons and ligaments), that is, mechanical load.

- Player load monitoring involves the search for an overall optimal loading of the body to generate positive training adaptations. This should take into account the energy demands on the body’s engine as well as the mechanical stresses on the body’s shock absorbers.

 external forces that athletes are exposed to (see Figure 2). These shock absorbers undergo considerable stresses from the high forces they need to generate against the ground during accelerations and decelerations. Rather than metabolic load leading to an empty fuel tank, this is mechanical load leading to wear and tear of the shock absorbers, which until now has been largely unexplored in the field. Particularly, the role of mechanical stresses on musculoskeletal tissue adaptations is generally less understood by the broad field of sport and exercise scientists. Whilst it seems logical that appropriate levels of mechanical stress will lead to desirable bone and muscle adaptations, it remains pretty much unknown what constitutes ‘appropriate’. Similarly, excessive accumulated stresses over time with insufficient recovery will lead to undesirable damage of the soft tissues (overload/overuse injuries), or in the worst case scenario to acute injuries when the individual stresses are simply too large for the soft tissues to resist. But when are these stresses ‘excessive’, and how could we monitor these?

Measurements of the mechanical stresses on athletes have largely been restricted to laboratory-based measurements of forces, mostly from force plates embedded in the ground. There is a linear relationship between force and acceleration as demonstrated by Newton’s second law of motion ($F=ma$). Estimating accelerations of the whole body (centre of mass acceleration) from accelerometry of individual segments is the closest we can get to estimating the forces that act on the body in the field. Some initial studies have shown that the linear relationship between centre of mass acceleration and acceleration from individual segments is rather weak during team sport related movements. An example of this can be seen in the bottom panel of Figure 1 where we have focused on the accelerometer signal during one single foot-ground contact of a running task and we noticed that the peak is higher than the peak acceleration of the athlete’s centre of mass. Some of the latest research is therefore taking a step back and focuses on new methods that allow us to better understand how accelerometry from individual body segments relates to forces acting on the body, and consequently the accumulation of mechanical stresses in the musculoskeletal system. Such better understanding will then allow practitioners to seek the optimal mechanical loads to induce those soft tissue adaptations that improve performance and prevent soft tissue degenerations.

**Figure 2.** Whilst GPS data can help monitor if there is enough “fuel in the player’s engine” to cover the energy demands of a training session, accelerometry data can help monitor the work performed by the body’s “shock absorbers” (e.g., bones, muscles, ligaments) to deal with the mechanical demands from the high external forces.

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**References**


A coaching perspective of the sport and exercise sciences

Dr Andy Kirkland and Vinny Webb offer suggestions on how sport scientists can enhance the coach-sport scientist relationship.

Introduction
In performance sport there should always be one ultimate aim, to enhance performance. This aim provides clarity in purpose to athletes, coaches, programme managers and support professionals and simplifies the decision-making processes: For example, by asking the question “Is what we’re doing contributing to the ultimate aim?” If the answer is no, then there is little point in doing it.

In a high-performance sport environment with extended support teams, there can be many different perspectives, and perhaps a lack of coherence regarding ‘business’ imperatives with other external agendas complicating matters. Successful teams will put personalities aside, be highly focused, working together to understand and support each other towards shared goals. Many performance environments use a coach-led, athlete-centred philosophy to develop effective teams and to maximise performance outcomes.

However, from our personal observations and seeking views of others, we suggest that there is a common perception that applied sports science support and coaching practice are often dichotomous. That is to say, that while both disciplines have the same ultimate aim, to enhance sporting performance, they can move in mutually exclusive directions to do so. Anecdotally:

• Some coaches believe that sports scientists do not understand the environment in which coaches work.

• Some sports scientists believe that coaches can be ill-prepared to use their knowledge and expertise or do not listen.

The purpose of this article is to provide readers with a deeper understanding of coaching practice and to offer suggestions on how sports scientists can work more effectively with coaches.

Understanding the client: Who is the coach?

Understanding Your Client is quite rightly a compulsory BASES workshop as it is essential to understand the environment of one’s clients and to be able to deliver complementary support services. In terms of practising within a coach-led and athlete-centred programme, the coach is often the most important person to engage and develop an effective relationship with. This is because coaches often filter all interventions to and for the athlete, coordinate other services and try to facilitate the optimal performance environment.

However, the relationship between the sports science and coaching camps can appear not too dissimilar to those between ‘sporting parents’ and coaches/managers. That is to say there are many examples of excellent relationships but there are many poor examples that infect the environment, and as a consequence athlete performance. To overcome such barriers sports scientists must take the lead in understanding the role, support mechanisms and environment of the coach.

The primary objective of a performance coach is to develop and enhance the sporting performance of athletes through holistic practice. In very simplistic terms, this involves problem-solving and decision-making processes utilising a myriad of sensory inputs, knowledge and previous experience. Coaches will turn to science...
to inform their decision-making processes; however, their level of expertise could see them basing any intervention on intuitive reasoning, informed upon through observed athlete behaviours and performance outputs rather than aggregating independently obtained solutions from published research.

The coaching environment is a complex and dynamic one in which coaches must focus attention on what they think is important at a particular moment in time. Although detailed planning may be required to identify and achieve process and performance goals, coaches must also be able to respond and adapt to an environment that is in a constant state of flux.

Therefore, developing a relatively consistent and stable environment in which athletes have mastered the fundamentals of their sport is vital. Sports science interventions must be appropriate for the age and stage of athletes. They are often surplus to the requirements until such a stable base has been developed, after which time a ‘marginal gains’ approach may be appropriate. Coaches can, and do resist testing regimes or interventions that they see impacting on training, are logistically challenging or where the link with performance is not obvious. Perhaps more frustrating for sports science professionals is that the expertise of some coaches may be perceived insufficient to understand or use the services on offer.

This is not to say that coaches lack intellectual rigour, but that they often solve problems differently to sports science professionals. Many performance coaches enter coaching as ex-athletes with minimal formal training or knowledge of sports science. Others simply reflect the views of leading triathlon coach Brett Sutton who said “the science itself may work in the laboratory but is totally flawed when applied to the real world.”

Sports scientists must therefore consider the individual philosophies of coaches as well as their ability to synthesise and apply complex scientific information. For those of us involved in supporting the next generation of sports scientists, it is also important to consider limitations in the way neophyte sports scientists are educated that may leave them poorly equipped to work with some high performance coaches and athletes.

The learning environment of sports scientists

Most scientific disciplines follow a reductionist approach in an attempt to understand phenomena. ‘Inputs’ are divided into smaller chunks, being labelling in terms of discipline and sub-discipline. Universities, the environment of practitioners in their formative stage of learning, are typically organised using a similar reductionist system.

Whilst such a system is essential in driving research outputs, it may also lead us to dismiss alternative solutions to solve problems unless we recognise the limitations of our discipline and personal biases. For example, Hargreaves (2008) recognised that he has to look beyond skeletal muscle physiology to advance understanding of fatigue and exercise limitation. An inference from Hargreaves is that to solve complex problems in science requires awareness and consideration of co-dependencies, regardless of which discipline they lie within.

Of course it is essential that practitioners must only operate within their field of expertise; however, as suggested by Bishop (2008) they must also consider how research findings can be implemented in a sports setting and consider barriers to uptake from coaches. Doing so requires not only an understanding of dependencies between other disciplines, but also communicating with coaches to define research problems.

Additionally, considering what evidence-based practice is and how it is applied in an applied environment is vital in terms of providing effective support. However, knowledge is in a constant state of flux, in which research often only confirms what a good coach already knows. Furthermore, research typically focuses on group data in which outliers can be seen as inconvenient artefacts rather than points of interest. Moreover, case-studies are typically viewed as inferior research outputs. In the world of the performance coach n=1. Top performers are often outliers from the ‘norm’ and individualised problem-solving approaches is preferential to solutions emanating from grouped data or meta-analyses. The Journal of Applied Case Studies in Sport and Exercise Sciences is certainly a step forward in this regard.

Could it be that a reductionist approach limits the solutions a sports scientist can offer a coach and that the interdependency between research and teaching in the academic environment implicitly indoctrinates methods that are flawed in the real world? Do some academic conventions constrain innovation and progress rather than fostering it?

These questions are not suggesting that a reductionist approach is wrong. Rather, it is to suggest that collaboration, through the sharing of thoughts, opinions and knowledge, between researchers, applied practitioners and coaches will result in more impactful practice. We also suggest that ‘complimentary sports science’ may be a better term than sports science support. This is because it does not infer a hierarchy and it may encourage a collaborative approach to problem-solving.

Conclusion and recommendations

If we want to truly deepen understanding and make a difference to practice, sports science should offer ways of finding answers rather than depositing information or enforcing convention. Sports scientists and coaches should take the time to understand each other’s perspectives, through collaboration and developing mutual respect. Sports scientists should take the lead through:

- Understanding how their expertise fits into the ‘big picture’
- Being patient in waiting for the opportunity to apply scientific expertise
- Influencing rather than intervening
- Complimenting rather than supporting
- Using language that works for coaches
- Solving the problems of the coach rather those relating to personal biases.

References:

BASES accreditation of sport scientists working in professional football

Chris Barnes provides an update on how the English Premier League has embraced BASES accreditation.

Introduction
At its inception in 1992, one of the stated goals of the English Premier League (EPL) was to support the national team by reducing the number of top flight teams from 22 to 20, and as a consequence of a lighter fixture schedule, produce players who are less fatigued at the end of the season. In the years since, the EPL has become the league that players from across the globe aspire to play in, due to its high media and broadcasting profile, and the fact that the financial rewards are staggering. Indeed, the number of non-UK and Republic of Ireland origin players playing in the EPL has risen from 22 in 1992/93 to 280 last season (2014/15). Whilst this influx of overseas talent has created a spectacle that is the envy of most other leagues, it also creates a challenge for those who are charged with bringing through new home-based talent due to dwindling opportunities. It could also be argued that it has adversely affected the national team’s chances of success, due to a smaller selection pool.

The Elite Player Performance Plan (EPPP)
In response to the diminishing numbers of top level appearances by home grown players, in 2012 the Elite Player Performance Plan (EPPP) was launched by the Premier League. The over-arching goal of the scheme was to ‘Increase the number and quality of Home Grown Players gaining professional contracts in the clubs and playing first-team football at the highest level.’ It also aimed to make clubs more accountable through the ‘implementation of a system of effective measurement and quality assurance.’ Clubs were initially independently audited against a series of criteria including productivity rates; standard of training facilities; and the quality of coaching, education and welfare provision. Clear objective criteria were also laid down in terms of resources required to support player development, including staffing and equipment to deliver a sports science curriculum. Following this initial audit, clubs were categorised on a scale from 1-4, with higher ranking clubs benefiting from increased central funding and higher status to attract players.

Accreditation of scientists working in football
Whilst the audit guidelines clearly spelt out the necessary educational and professional qualifications to be possessed by coaching and medical staff, there was less clarity with regards to sports scientists. Indeed, a lot more attention was paid to the equipment a Department should invest in to achieve Category 1 status, than the qualifications staff should possess to work as a sports scientist. Thus, whereas all clubs employed physiotherapists who possessed as a bare minimum an Undergraduate Degree and Health and Care Professions Council Chartered status, the role of sports scientist could be occupied by individuals from a range of professional backgrounds (e.g., physiology, strength and conditioning, physiotherapy) and with varying levels of qualifications.

To rationalise this concern, the sports science staff at the Premier League (Dan Hunt and James Bunce) undertook a thorough review of the range of professional qualifications available to sports scientists, and concluded that Accreditation via BASES was the most appropriate benchmark to be universally applied for sports scientists across EPPP Category 1 Academies.

In a series of meetings between the EPL and BASES the operational detail of the scheme was mapped out. Many of the Category 1 clubs already employed very experienced practitioners in senior positions in their academies, and it was believed that these staff should be encouraged to apply direct for accredited/chartered scientist status, and in selected cases BASES High Performance Sport Accreditation. This move to fast-track senior staff was welcomed by the clubs, but has also created a pool of suitable candidates to train to be supervisors/reviewers for less experienced colleagues going through the Supervised Experience (SE) pathway. In the first round of direct applications in December 2014, eight practitioners were awarded Accredited (and Chartered Scientist) status, with a further five achieving HPSA. Approximately 10 direct applications have been received in the July 2015 round, which should further enrich the pool of kitemarked practitioners, and potential supervisor/reviewers.

Following the first supervisor/reviewer training workshop in August 2015, less experienced staff will register on the SE pathway. Through the series of core workshops, and regular meetings it is expected that the strength of the sports science community in Professional Football will grow. The scheme will also ensure that sports science as a profession will be viewed with equal status to other professions in the game. Interestingly, although the scheme has been initially introduced for Academy staff in Category 1 EPL clubs, a tremendous amount of interest has been shown both by colleagues working with Senior players, and by those working throughout the Football League. Indeed, it is very likely that, in the future, the programme will be expanded to assist with the professional development of practitioners working at clubs in those leagues also.

Chris Barnes
Chris is an Independent Sport and Exercise Scientist, working with a range of EPL clubs over the past 20 years. He holds BASES High Performance Sport Accreditation.
One person who inspired me
I found a lot of early inspiration through sport. However, it was mainly through martial arts training in my mid- to late-teens that I saw what amazing things could be achieved through perseverance and dedication. I drew inspiration from many of the Japanese and English karate teachers I was training with and this ultimately influenced my choice of career.

One book that all sport and exercise scientists should read
I enjoyed reading Clive Woodward’s book *Winning* as it contains a lot of good leadership messages and is set against a backdrop of England’s fantastic 2003 World Cup campaign. It is clear that Clive had a lot of difficult barriers to overcome but was very innovative in his approach. For something slightly different I would recommend *The Power of Now* - heavy in places but this book really emphasises the importance of living in the present moment.

One moment that changed the course of my career
I had been made redundant after completing an engineering apprenticeship and in the Winter of 1984 found myself standing in a hole digging the dirt as a jointer’s mate. I was on the verge of competing internationally in my sport (karate) and thinking that there must be a career that I could be more passionate about! I resigned and went back to college to study A levels. Soon after I gained a place at Loughborough University and it felt like I’d been given a second chance. I had found my vocation.

One great thing that sport and exercise science has achieved
For me it is the relatively recent emergence of *Exercise as Medicine*. A lot of important questions still need to be asked and more prospective intervention trials with long-term clinical end-points are needed - but this creates challenges. Another challenge will be translating the best evidence into new models of public health and patient care.

One thing that I think makes a great conference
Great venue, a programme that has a good mix of experts and talented early career researchers, topical/cutting-edge overarching theme and a spirit of collegiality and development.

One book that all sport and exercise scientists should read
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One thing that made me want to be a sport and exercise scientist
A real passion for wanting to understand more about how the human body responds and adapts to exercise, fuelled at that time by my involvement in elite sport and training for optimal competitive performance.

One bit of advice that really influenced me
I was fortunate to have supportive parents and grandparents who worked hard and made the very best of what they had. They instilled in me important values and trusted the choices I made as a young adult. I can’t say that there was any one bit of advice, it was more about following their example.

A proud moment
My proudest moments without doubt have been associated with seeing my kids grow up and sharing their achievements. However, as a competitive athlete, winning the national shotokan karate championships and representing England in the 1985 World Championships is very memorable. In my career, my first presentation as a PhD student at the 1992 ACSM Annual Conference in Dallas. Here, I was introduced to Priscilla Clarkson by Ron Maughan and then spent a good chunk of my final year working in Priscilla’s lab in Massachusetts. It was hard work but a fantastic experience and I would recommend the experience of spending time in another lab to all PhD students, should the opportunity arise.

An embarrassing moment
My eyesight is not as good as it used to be. When I was chairing a conference session recently I got one of my speakers mixed up with a ‘lookalike’ gentleman on the front row. Thankfully, they both took it very well and by the end of the session had found a new friend!

One thing I like to do on days off
I am fortunate to be living near some of the most amazing countryside and coastline in the UK and always endeavour to make the most of it at the weekends.

One quote that I really like
There is a quote by Theodore Roosevelt that I came across when I was a PhD student and this has served me well throughout my career:

*Do what you can with what you have where you are.*

That being said, this quote attributed to Samuel Johnson also strikes a meaningful chord:

*To be happy at home is the ultimate result of all ambition.*

Prof John Saxton FBASES

John is Head of the Department of Sport, Exercise and Rehabilitation at Northumbria University. He is a BASES accredited sport and exercise scientist and a member of the BASES Conference 2015 Scientific Programme Committee.

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