how to be a successful

SPORTS COACH

A SPECIAL REPORT FROM

PEAK PERFORMANCE

The research newsletter on stamina, strength and fitness

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From the editor

The world of sport is littered with coaches who bask in the shadow of their athletes. Most go unheard of but there are a few who are able to step out into the light on their own to become almost, if not more, famous than their charges. We're talking here about the likes of Arthur Lydiard and Percy Cerrutty from the world of athletics, Nick Bollettieri from tennis, Jurgen Grobler from rowing and Sir Alex Ferguson from football, for example – all coaching luminaries. This PP special trades on the thoughts and beliefs of elite, world-renowned coaches, such as conditioning expert Tudor Bompa, England rugby world cup winning coach Dave Alred, and Olympic rowing coach Terry O'Neil, and one of the world's most well known coaches, Frank Dick.

The special report is divided into specialisms and areas of conditioning, such as strength, speed and endurance. Each coach provides an insight into how they coach this area. They also offer their opinions on what they 'believe in' – remember that although their coaching practice will be informed by science, there will still be a heavy element of art, ie of 'knowing' and using intuition to frame a coaching programme that matches the theory with the reality. The coaches also provide practical examples of the work they have done with sportsmen and sportswomen including rugby internationals Johnny Wilkinson, Paul Sackey and Danny Cipriani, and athletes such as Daley Thompson. And on a more general level many offer their thoughts on what makes a good coach and how they got into coaching.

This PP special will be of benefit to all coaches – it will enable you to frame your own philosophy and approach to coaching and gain an insight into elite sport. The practical information will help you understand the science of coaching and the way that these top coaches use it in the 'real world' to create world-beating performance in those they coach.

John Shepherd

Popular delusions and the madness of coaches!

Coaching has always been something of an art. But in a thought-provoking article, **Tom McNab** *argues that many coaches should pay more heed to science and less to following the latest trends…*

Extraordinary Popular Delusions and the Madness of Crowds should be obligatory reading for all coaches. It was written by Charles Mackay back in 1841 and details the various crazes that have afflicted mankind over the centuries. Among those discussed are The South Sea Bubble, Tulipomania, and the Crusades. Indeed, the list of lunacies to which mankind has at some time subscribed is a long one!

Athletics, and in particular running, has not been immune to such delusions. Prior to the practice of coaching, and in its early years, this was both understandable and excusable, because science had not yet been extensively applied to sport. However, it is less excusable now, especially when some degree of scientific scrutiny can be applied to each new technique or training method.

'Since 1957, various mutations of circuit training have emerged, but little in the way of research to show that these variations have any value in specific athletic events has been performed'

Past (and present) delusions

It might be worthwhile to cast our eyes back to history to consider some past delusions and some that are still in vogue today (see boxes 1-8). Now, not all of these ideas were totally misguided; some simply represent misapplications of valid training methods. However, I hope that they might, in their totality, put in perspective some of the flabby thinking that has often invaded some recent coaching methods.

As I said at the outset, not all of the methods described here have been discredited. Some (like interval training and 100 miles a week) were simply misused or misapplied. Some, like

1. Sweating and purging – this was a popular practice considered to be beneficial to performance and whose use is documented from as early as 1700. Sweating and purging at least had the merit of following the existing medical theory of the 18th century, which was dictated by the four 'humours' (black bile, yellow bile, phlegm and blood), but endured well beyond the period when medieval thinking had been discarded by the medical profession, and was still being used by professional runners and footballers as late as the middle of the 20th century!

2. Drying out – this method was extensively used in the 19th century, as a means of weight loss, but according to the 1954 Commonwealth Games marathon winner Joe McGhee, drying out was still being use even as late as the 1950s, where fluid intake was discouraged, even in marathons.

circuit training (though of some value for the unfit) must be seriously questioned as a means of training for mature athletes. And some, like speedball, are just plain daft! The problem is that all have been at some time accepted as Holy Writ, and this of course begs the question of how many of our present widely accepted training methods will stand up to serious scientific scrutiny.

Drills training transfer

It is, I believe, possible to determine which course a coach has attended by the drills he presents to his athletes a week later! The big toe drill, the left eyebrow drill, a drill for the index finger devised by Professor Alucard of Transylvania University – any or all of these can be adopted by coaches simply because that drill has become the current orthodoxy. In very few cases are these drills subjected to even the slightest scrutiny. This is often because coaches believe they must surely be right – they are after all being proposed either by an ex-international or by

the coach of a prominent athlete!

Thus, within a week after any course, various mutations of these drills surface all over the place, many as different from what were originally demonstrated as I am from Hercules! At this point I should raise my hand and plead guilty; I have for years used and developed the running drills of the late Bud Winter (former US Olympic track coach). Indeed, these drills helped to take British 100m runner Greg Rutherford from around 11.50s to 10.38s in two years. But then these were not isolated drills taken out of the event, but focus-drills that all were practiced within the skill of running itself.

Effective drills are all about transfer of training and might therefore better be called 'related practices'. Assuming it's valid and practised within the skill of the sport itself, to be effective any drill must be applied within the full movement as soon as possible if there is to be successful transfer. However, what is more often observed on the training ground is 'drilling', with athletes of widely varying abilities, and all for some reason doing the same number of repetitions, but in isolation, with no early transfer to the event itself!

There is ample precedent for this type of activity. I well remember land drills, deployed as late as the 1950s as a means of learning to swim. The fact that, when I was placed in the

3. Interval training – was originally devised by the German Woldemar Gerschler in the late 1930s, and used in the training of Rudolf Harbig, who ran 1.46.6 for 800m in 1938. Gerschler's original interval training was based on the application of scientific principles and was essentially resistance training for the heart. However, it was picked up by British and other coaches in the early 1950s, and deployed in a whole range of events, from sprints to long-distances, without modification. Therein lay the problem – the assumption that interval training was some sort of universal 'scientific' panacea for all events, an assumption that is still sometimes made today.

4. Circuit training – this was a form of progressive, low-level resistance training created by British physical educationists Morgan and Adamson in the 1950s and based on high-repetition exercises, sometimes performed for anything up to 90 minutes or more. Circuit training never claimed to be anything other than a means to achieve raw general fitness and its specific relevance to particular athletics events or to trained athletes was always questionable. It clearly possessed local and general endurance factors and (for non-athletes) a strength element, but the central issue has always been lack of specificity.

Since 1957, various mutations of circuit training have emerged, but little in the way of research to show that these variations have any value in specific athletic events has been performed. Indeed, despite the fact that there are no physiological principles that could possibly be advanced to support such sessions, I have come across a number of recent instances in which national level sprinters were told to perform one minute on, one minute off exercises with either no resistance or very light weights. It's incredible that these kinds of circuits are still being employed for sprinters in the 21st century!

5. Sand running – this was heavily deployed by the eccentric Australian coach Percy Cerutty in the training of the great Herb Elliott, who was the 1500m champion in the 1960 Olympics. As a result, the early 1960s saw runners all over the world seeking out beaches and sand-quarries to no great purpose except an increase in Achilles tendon injuries! Of course, the main reason Cerutty used sand hills was simply because they were the only facility he possessed. Had he lived near a track then it's quite probable that we would have heard little of sand running. However, this is not to say that there is no value in occasional sand workouts, for example, in the development of the muscles of the foot. What it does serve to do is to reemphasise that there are no magic methods, and that coaches need to adapt to circumstances and deploy the facilities available to them.

6. 100 miles per week – like sand running, very high mileage training can be attributed to a specific coach, the New Zealander Arthur Lydiard, who was the coach of the 1964 Olympic 800m and 1500m gold-medallist Peter Snell. I spoke at length with Peter some years ago, and he informed me that as far as he could recall, he had never covered a hundred miles in a week! There was little need because both of his events demand high levels of basic speed and strength-endurance, rather than the qualities developed by long-distance running.

It is well known that prolonged endurance training, for example long, slow distance runs of 2 hours or more, will promote mitochondrial development, increasing aerobic capacity and endurance. However, this is to take a one-dimensional view of training; any study of mileage will show that injury rates rise steeply around the 50 miles a week mark[(1)]. There is also a negative impact of long slow running upon fast-twitch fibres. What all great runners like Snell possessed was high levels of basic speed, in his case a 47.7sec 400m. The need to develop basic speed is something that we have tended to neglect in distance training.

pool, I was still quite unable to swim bothered my teacher not a jot. He had taken me through the drill. The fact that I could not swim was my fault!

Football drills

Let's take a look at football, where the Dutch coach Coerver has devised a series of ball drills for children. These include the 'Cruyff step-over', the 'Ronaldo shuffle' and many others. However, Coerver tries to put these mini-skills into two against one and small team games as early as possible, in order that there is effective transfer. Without that, they remain sterile drills with little practical value.

All of this is not to deny that most drills have some value. What I'm hoping to do here is to question the amount of time spent on them, (particularly with beginners), to stress the need to secure

7. Speedball training – in the early 1970s, a Scottish professional 'school' suddenly became the bane of bookmakers by apparently turning modest runners into champions in a matter of months. They deployed the speedball (essentially an old-fashioned punch ball) together with thousands of 'chinnies', an ancient abdominal exercise beloved of professional boxers. However, I well remember witnessing a Scottish coach dedicated to the use of speedball training in front of the national boxing coach at the time, who dismissed the speedball as a training method for boxing, let alone athletics! The enthusiasm for speedball training wasn't just confined to the voodoo world of professional athletics in Scotland; its use was also vigorously supported by quite a few other national coaching directors, whose names will not be divulged here in the belief that we should not torment the afflicted!

transfer, and the importance of subjecting each new drill to rigorous technical scrutiny. Each moment we spend with an athlete must have a justifiable purpose and measurable benefits.

It is said that the discus thrower Wolfgang Schmidt of the former East German Republic admitted that, although he described dozens of discus drills to coaches eager to learn new techniques, he only ever used two of these drills himself. His explanation was that he was only providing what coaches wanted to hear, and what they wanted was to return to their athletes with a fresh set of drills!

Summary

The 'good old days' are usually only evidence of bad memory. But in the past, national coaches tended to act as a filter for any new ideas. Now, however (in the UK at least), the link between our voluntary coaches and practical international level coaches who are capable of subjecting new methods to some degree of rational scrutiny has gone. But there is no good reason why coaches cannot create filters of their own by subjecting new and fashionable drills and trends to good old-fashioned scientific

8. Passive stretching – it's worth mentioning here that we're not discussing warm-up mobilising, or for that matter, therapeutic stretching as directed by physiotherapists. Nor are we discussing post-exercise stretching, for which there is good evidence of value[(2)], in terms of recovery. What I'm questioning is the value of high volumes of passive stretching vis-à-vis injury prevention, something, which has never, up till recently, been subjected to scientific scrutiny. But now it has, and the evidence is strong that it has no protective value, indeed that it may on occasion damage muscle tissue. Indeed, it is worth observing that even the most casual of studies of ballet dancers would show that for all their stretching, their injury rate is probably even higher than that of athletes. What is ignored by many coaches who advocate passive stretching is the fact that muscles work synergistically, contracting and relaxing in harmony. The best way to prepare muscles for a specific activity is to rehearse the movements (or substantial parts of them) of that activity at varying speeds.

scrutiny. This being said, it is important to repeat that coaching is not a science, but rather a practical art – it is how we deploy scientifically tested methods that will determine our success as coaches. But someone or something must surely be created to protect us from another speedball and to evaluate Professor Alucard's index finger drill!

Referemces

1. 1: JAMA. 1982 Dec 7;248(23):3118-21
2. Am J Sports Med. 1993;21:711-9

Learning from other sports – what makes a great coach?

John Shepherd *talks to* **Dave Alred MBE**

The last moments of the 2001 rugby World Cup final: Jonny Wilkinson steps back into the pocket, swings his leg, contacts the ball, the seconds the ball travels to and through the posts seem like an eternity, but the roar of the crowd is electric, three points and England lift the Webb Ellis trophy for the first time. For Dave Alred hours and hours of specific work with Wilkinson and the England team have come to fruition in those few moments.

I begin to interview Dave Alred just as I would any one of the many top sports performers, coaches and sports scientists that I have in the past. But after just a few minutes my journalistic pretences have been dropped, along with his guardedness about speaking to a member of the 'press'. We end up talking sport like old friends – such is the passion that we both share for maximising sports performance. I ask him about the mental process, about what makes someone like Wilkinson tick and hit the target with metronome precision. Alred explains that the process is a physical and a mental one, and that the two factors are inextricably linked. He analyses technique to the 'nth degree', but indicates that he is just as thorough with the way he approaches the mental side. This can unlock the sports skill.

He contextualises this through his approach to rugby goal kicking, 'If I was to say to you 'Stand 30m back and kick a rugby ball against a barn door 1000 times' I would expect you to miss

a couple of times, even if you don't think that you would. However, if I told you to aim at the key-hole and focus on that, I don't believe you would miss.'

I begin to understand, 'I'll say to the kickers, strike a particular stitch on the ball so that they make the right contact, and I'll get them to aim at someone in the crowd to tunnel in their accuracy.' He is so precise in his thinking that he knows that kickers will, for example, be able to kick harder and further as their big matches approach across the training week's preparation, so he'll get them to practise longer kicks closer to the match – due to the increase in their adrenaline levels.

I ask about the heat of the moment and how a player can avoid tension. He indicates that it's about the repetition and mental and physical cueing. Jonny Wilkinson gets his kicking head and body on by physical and mental cues. His hand movement – which, incidentally, was borrowed from baseball, explains Alred – sets the fly-half up into 'place kick mode' and shuts out the nervous energy coursing through the player's body that could make him crack and miss.

'You have to give players quick references or mental keys that help them perform under pressure… this relates back to the tensions between processes and outcomes. I want to provide the tools that will focus on the process,' explains the coach.

I ask about drop goal scenarios – these are more prone to being less rhythmic and contrived than place kicks and are affected more by external, less controllable factors, like a loose forward running down the drop kicker's throat! Alred acknowledges this but talks about his work with Irish, British and Irish Lion's fly-half Ronan O'Gara. He explains that he spends hours kicking with O'Gara in a way that is designed to ensure that he gets perfect contact with the ball. He shows me by demonstrating a method of kicking that will be inaccurate. Unfortunately it's probably the way that most of us would actually kick. He lines up to swing his leg at an imaginary ball and kick through the mark, but explains that this would not lead to optimum accuracy. Then he shows me his way, where you actually follow the ball in the direction you want it to go.

The ball is struck and then you literally follow it in the line you would want it to travel. He gets his rugby players (and the footballers he has worked with, including England's Joe Cole and David James) to do this. You can see that he feels the movements and the way he gets them across makes you feel them too. This is achieved with those he works with to such an extent that the kicking action becomes natural and fluent, regardless of the situation players find themselves in. I ask about football players and Alred explains that there is a reticence among managers and coaches to allow him access to work with their players. He puts this down to the nature of the game and some of the out-moded attitudes that exist within this ball game. Obviously peeved at the situation he says that many footballers, 'Can't actually kick properly.'

Alred has worked in many sports as well as rugby where he initially made a name for himself. He loves to learn from other sports, 'I'm a firm believer that all of the things we have, in our here and now of coaching, are being done better by someone else,' he says by way of his quest for learning. He mentions that he has recently been working with England's cricketers and we talk at length about their run-ups and how to hit the mark and avoid no-balling. 'When they (the bowlers) are under pressure they would normally bowl short,' explained Alred. He goes on to explain about the need to be a 'J' rather than a 'C' shape when performing a sports skill. He indicates that when technique begins to suffer, no matter the sport, the player will inevitably close their stance or action – they will bring their chest toward their legs, for example, thus making more of a C shape. This will negatively influence their technique. 'If they are J shaped the athlete will be much longer and bigger… a golfer will swing without tension and in a wider arc,' explains Alred. It's insights such as these that indicate why he has made such a success out of coaching.

I ask how the players take to his all-encompassing approach to training, which combines the mental and the physical. I explain that in my numerous chats with top-class sportsmen and sportswomen that they often believe that they are mentally tough. Alred answers in a way that should make any athlete

(whatever their ability listen), 'If they think that they are already mentally tough, then how much better would they be if they were tougher?'

We move on to the art of coaching and what exactly coaching is. 'You've got people who coach, but they don't actually coach,' explains Alred, adding by way of explanation, 'What they do is tell and instruct. The coaches that manage the athlete's learning and the ones that start from there are the coaches.'

He believes obviously that preparation is crucial, we chat about training planning and the time needed to reach peak performance, 'Everyone overestimates what they can achieve in a year, but underestimates what they can achieve in four.' He explains that the foundations should be laid in year 1 and that time should be spent on finding out what works for the team or the individual. He believes that if you don't do this then years 2,3 and 4 will always be a bit rocky. In term of getting individuals or teams ready, Alred uses the analogy of a computer screen with a line across it. He describes the screen with three or four 'word documents' underneath the line. These, he explains, are your specific sports techniques, and should be worked on individually. These are then put into the folder above the line, but there will be one or two keys that will be used to unlock them.

'The skill is to play off of the (one) folder… the cardinal sin in a game, for example is to open the (smaller) folders and start tinkering with their contents… It's the transference of the word documents below the line to the one above it that I think is often what's missing.' Alred is basically saying that you need to work and work on training in all aspects of the game or sports skill (the folders below the line), and then use the keys in the game/competition to unleash these, almost on auto-pilot (the above line folder). We're again back to the scenario where the process and not the outcome becomes the crucial aspect in creating winning performance.

Any aspiring coach would learn a huge amount from the work of Alred – the thoughts and ideas presented here, will act as a valuable reference for all coaches regardless of sport or level.

High performance coaching

John Shepherd *talks to one of the top track and field (and other sports) coaches in the world* – **Frank Dick**

It had been a good few years since I'd last heard Frank Dick speak. I recalled the rousing speeches he used to give when I was a member of the GB track and field team, before we went to do battle with our international rivals. I was enthralled (and entertained) then by what he had to say, and a decade or so later I was equally engrossed when we talked about coaching, drugs, ethics, UK athletics and the mental toughness of today's athletes, among other things …

John Shepherd: Do you think coaching an athlete has become over-complicated?
Frank Dick: Yeah, in a nutshell yes. There are a whole new lot of positions that have come into play in athletics and I think that the athletes can feel that they don't know who is running the show. To me, the process should be athlete centred, coach-led and performance services supported. We now have a world with performance managers, performance directors, sports scientists – but they are not coaches. The coach can therefore become disenfranchised. And the athlete begins to think that these people are more important than the coach and they're not.

(Frank then began to relate his coaching ideas to Formula 1 and his work with the Ferrari team, stating that despite all the technicians and science involved in the sport that the driver is number one and that this is never lost sight of. In response he talked about the intuitive and 'gut feeling' nature of coaching.)

FD: If you're not careful you start waiting for all the scientific evidence to be in place before you make a decision. It actually takes away from you the capacity to make a decision. Coaches are supposed to be calling the shots out there at speed. The coach is rather like the conductor of an orchestra… the only person that understands the total process of pulling it [the musical piece] all together. Yet the coach is not in the same league as the people who make the music.

(At this juncture Frank talked about his work with Daley Thompson and the 'ensemble' of coaches that were brought together as he 'conducted' to make Thompson the greatest ever decathlete).

JS: Back in my day when I was competing internationally when you were giving the team talks, we seemed to have better athletes. I recall being in teams with Daley Thompson, Allan Wells, Coe, Cram, Roger Black and so on and therefore one could argue we had better coaching …
FD: I think the climate in which we exist has changed desperately. In the old days there weren't so many distractions. We all found an immense sense of personal pleasure in what it took to be an athlete. I think the younger generation today thinks it easy to get success in a moment – due to TV programmes like Big Brother, for example. Convincing young people that blood, sweat and tears are necessary is something that needs to be addressed or we will lose future generations of athletes forever.

(Frank then went on to talk about the nature of fame in the 21st century, giving the example of Anna Kournikova and how, despite not being the best female tennis player, she is one of the wealthiest and perhaps most well known of players of either sex, for what she does off-court)

FD: …fame and wealth are also evidence of success, well that's not how you and I were brought up in athletics; you hit the line first, you jumped further than somebody else and so on and

that's what winning is. And if you don't think that's what success is, then I don't know what you're doing in track and field in the first place.

JS: Two of my contemporaries said that they thought that today's athletes were soft

FD: Let me take up what you say there about being soft… I did a presentation in regard to the lottery a while a go, and I said to them, it's wonderful that we have access to the economics, but how you use the economics is crucial. You have to understand that how we develop people in life is crucial and gives them the power to climb higher and higher mountains. You don't do this by solving the problems for them, but by giving them the right level of challenge. You give them the tools, but you ask them to solve the problems, or when you reach a world or Olympic final and real challenges present themselves, the athlete won't know how to meet them because up until then people have solved the problems for them.

JS: That leads me onto another point, I thought that the eighties athlete had a stronger mentality

FD: Absolutely, you really have to learn to fight for it. A few years a go I was at a major championships and an athlete, who I had huge respect for, ended up running better in the 200m quarter final round rather than the semi-final, when the conditions and lane draw were much better. Why? I believe he was thinking to himself, 'Well, I'm not going to do that well now.' I remember Gary Oakes running to a bronze medal in the 1980 Olympics in the 400 hurdles from lane 1 against all odds…

This brings me back to 'what is winning?' It brings me back to the very earliest days of an athlete. Winning is 'being better today then you were yesterday'. It's about getting a pb after a pb and getting into a position when your pb will make you the best. It is about having that drive and that commitment. I recall when you'd hear foreign coaches talking to me 'the British fighting spirit'. Everyone has heard that comment, (but) they (the foreign coaches) knew that if you had a British vest in an

event, their athletes would have a fight on their hands and it would never be over until they hit the line or the last round was completed. Today, I don't hear that and I don't perceive that.

JS: So, why's this?
I believe that this (the fighting spirit) is being interfered with through the new structure, although not intentionally, and the way this effects coaches. That conduit (the coach/athlete) relationship has to be kept open. We don't want a world where that athlete is listening to this and that other person and hearing different things. Often the athlete is not in the right position to decide what is right and wrong and that is what the coach does.

JS: Do you think the sport is doing something to return the role of the coach to one of greater centrality?
FD: It has to or the wheels will fall off. Dave Collins (former UKA performance director) is an outstanding performance director, I can hear his frustrations in a lot of things, but he is the Ferrari team manager. We need to create the 'Schumachers' to drive the car and coaches to get them there. The athlete has to be central and be helped to stand on their own feet to be able to perform at their best by good coaching.

JS: There seems to be a lack of direction in the sport since the late 1990s that comes back to a confused coaching strategy
FD: I agree. We lost something in the nineties. I think the sport was so entangled with commercial issues that it was difficult for people to focus on the overall picture and the things that would make the whole thing work. We had a lot of great players in there, like Dave Moorcroft, wonderful athlete, wonderful man, maybe a little bit soft when he could have been hard at times – but then that's the nature of the man. Malcolm (Arnold) then didn't stay around that long. He's one of the finest practical coaches in the world …..but I'm not sure if he really wanted that role in the first place. And Max (Jones) got caught up in too many other things trying to fire fight. And so the focus on top performance could not take place. You need coaching being championed and developed.

JS: What about your legacy to UK athletics?
FD: Well, anyone who ever knew me, knows that I had a desperate, desperate passion for coaching (and) it's coaching that makes it (athletics) work at the end of the day… we have such a legacy of quality coaching in this country and I can't believe we've lost the athletes. I don't believe that our trees are stripped of ripe fruit. They're there, as is the coaching DNA, and it has to be allowed to develop again.

JS: What about your own coaching career?
FD: I never asked to coach anyone; they all came to me. And that provides an advantage, as you don't have to prove anything to them. I had a wonderful group of athletes, from Daley, Kim Hagger to Lorna Booth to Dalton Grant.

JS: How long did it take you to come up with your winning formula?
FD: It took a long time, you do your reading and you come up with a kind of a framework that works for the athletes that you've got. You work within what you know. You never stop learning.

Frank Dick short biography

Frank Dick was educated at the Royal High School in Edinburgh before moving to Loughborough to train as a teacher of physical education and mathematics between 1962 and 1965. Frank also studied sports science at he University of Oregon.

In 1970, he became national athletics coach for athletics in Scotland and in 1979 he became director of coaching for UK Athletics.

Frank has worked with numerous sporting greats, for example, Boris Becker in tennis, Gerhard Berger in F1 racing, Katerina Witt in ice-skating and Justin Rose in golf. Few coaches have successfully transferred their expertise across so many sports in this way and at such a high level.

Frank is president of the European Athletics Coaches Association. In 1989 he was awarded the OBE for services to sport and in 1998, he was inducted into the UK Coaches Hall of Fame and was presented with the prestigious Geoffrey Dyson award.

Today, Frank remains a successful coach in both the sports and business world.

Interval training for middle distances

UK Athletics elite coach **Craig Winrow**
Interview by **Andy Barber**

Craig Winrow is well qualified to talk about interval training for middle distance athletes. He was UK Athletics' event coach for 800m and 1500m and at the time of interview was their performance development coach working out of the UK Athletics endurance performance centre at St Mary's College, Twickenham. Previously he coached in the US collegiate system and as an athlete competed over 800m at the Atlanta Olympic Games in 1996.

'There is no magic formula. Most people coaching to a certain level in the sport are doing the same type of work with their athletes as one another,' commented Craig, continuing, 'It is well known, for example that you are going to be doing certain types of intervals and that there is a certain volume of work that an 800m or 1500m runner is going to be progressing toward. However, how these ingredients are put together and made to reflect the needs of individual athletes is crucial.'

Winter workouts

In the winter Craig's athletes do interval sessions twice a week (Tuesdays and Thursdays) and there's also a hill session on Saturdays – these are performed around lactate threshold (the point when energy production starts to shift more significantly toward anaerobic metabolism – although aerobic metabolism supplies the majority of the energy).

Craig often trains his middle distance athletes with long distance (5 and 10k) specialists. He reasons that the needs of

the two groups of athletes at this time of the year are very similar and that they get the benefits of working together.

The coach explained that at the start of the winter the athletes do a longer type of interval session on Tuesdays. Specifically they run between 8 to 10k of long intervals made up of distances, such as kilometres or miles. However, Craig identified that this was not suitable for all middle distance athletes. 'You can't just say, "Here's the session, get on with it". You have to pick and choose how different athletes will respond to it. The biggest part of coaching is working out the type of athlete you have got hold of and what kind of training they are going to benefit most from.' He singled out Andrew Osagie, a 1min 47sec 800m runner as not being able to handle these sessions. This means that last winter (07) Osagie's Tuesday sessions were lower in total volume, with his overall training having a greater speed based emphasis. To get Osagie ready for the longer intervals, Craig is increasing the length of these workouts (the number of reps) and building Osagie's base endurance through more mileage on a long-term basis.

'The biggest part of coaching is working out the type of athlete you have got hold of and what kind of training they are going to benefit most from...'

Craig explained that the key to the Tuesday sessions is to develop an athlete's endurance. The aim is to work towards that 8-10k of running off relatively short recoveries. The sessions are done on grass to make them easier on the legs. This reduces the risk of injury and if the athlete is not suffering with muscle soreness also enables them to do more effective training throughout the rest of the week. In fact when the athletes start training in October they don't use the track at all. Learning from his own experiences as an 800m runner the coach explained that although he enjoyed being on the track, running fast in spikes, in hindsight he realised that there was a strong correlation between this and his own Achilles tendon problems. He has seen the same problems in other athletes who have also done lots of track work.

Thursday sessions

The winter Thursday session is shorter then the Tuesday ones and a typical session moving into the spring would be, 10-15 x

Learning from personal experience

Can a coach produce truly successful athletes if they have not competed at elite level themselves? This is much debated in coaching circles. I believe that it is certainly an advantage to have competed at international level – for example, you will know what it is like to perform before a big crowd, what the nuances (and pain) of training feel like and how an event should be performed technically. Through my own track and field coaching I often find myself, as Craig suggests, going back to what I did and what it felt like. This often opens the door to further learning and improvements on the part of the athletes you are working with. You can intuit what they are going through and draw on your own experiences – with the aim of making them better athletes than you were. They may also listen to you more, as you have 'walked the walk'. Of course there are numerous coaches who have been successful with those they coach, but I believe that more and more elite coaches will be former elite sportsmen and sportswomen.

400m reps with 1min rest between runs. Craig explained that this type of fast session is constructed in a number of ways. 'You can run 300s, or do 400m/300m/200m or 500m/300m/200m down the clock work outs. It is about what you are trying to get out of the session. The specific content (interval distances, Ed) is not as important. It is about the volume and the recovery.'

Saturday sessions

As mentioned the group does hills on Saturdays in Richmond Park. The sessions involve 30sec to 3min efforts and the recovery is kept short.

Preparing for the track season

From February to March the athletes begin to work on the track. 'When we get down to the nitty-gritty of preparing for racing, that is when I do use a lot of work where we are trying to hit certain times for certain intervals,' explained the coach. Craig has benchmark times he believes that an athlete needs to

hit in training in order to race well. For example, he believes that an athlete looking to run a 1min 46sec 800m should be able to run 600m in 76sec and 1k in 2min 25sec. From these targets the coach can plan backwards. If an athlete is going to clock these times in a high quality session, other sessions need to progress them toward this throughout their winter training. This will involve targeting both speed and endurance.

Craig provided an example of a workout an athlete may do in the build up to racing, 'A classic session is 1k, 600m, 400m, 200m with big recoveries, hitting all of the runs pretty much flat out.' He believes that these provide a good indication of how the athlete will perform when it comes to racing. 'I'm a big believer in running at the pace you are meant to be racing at,' commented the coach.

Building speed without an endurance base, the dangers

Too much speed work and not enough endurance, can lead to problems. Craig says he sees a session such as 10 x 400m (each 400m within 1 minute) with 1min recovery as an important target if an 800m athlete is looking to run 1min 46sec. However, the danger with doing too many of these workouts is that the athlete can leave their 'best' on the training track and not on the competition one – and without control of training on the part of the coach, they could also peak too soon. The transition into the track season and the use of such quality sessions has to be carefully planned.

The coach said that this was something that fellow UK Athletics coaches, Mick Woods and Mark Rowland had introduced into their coaching and he had adapted for 800m and 1500m athletes. He explained that threshold running is now much better understood than at the outset of his own athletics career. Basically, done regularly, and within a progressive and relevant training programme, it will boost the runner's ability to move at fast paces with reduced lactate build up, thus conserving their energy.

Craig explained that improvements in sports science mean

Lactate threshold running

As indicated, lactate threshold is reached when lactate (a body chemical that is involved in energy creation) builds up in the working muscles and anaerobic energy metabolism begins to become significant – although aerobic energy production is still in the ascendency. Intervals can be constructed so that the increase of lactate stays below, on or above threshold. Specifically, lactate can be measured through blood samples, usually taken from the earlobe, whilst the athlete is exercising in controlled conditions. Craig has added sections of threshold running to his interval training recently. For example, a session may begin with 10min of threshold running before competing a fast 600m and a series of 300m efforts.

that coaches can specifically incorporate lactate threshold training into the schedules of their athletes and can be more precise when setting their levels of effort. Physiological testing and the use of heart rate monitors have all helped in this respect. It is now possible to say precisely whether a run is an easy recovery one, a steady state one or a threshold effort. Being able to set and monitor this means that an athlete's recovery and workload between tough interval sessions, for example can be managed much more effectively, with the result that overall training progress is made much more systematically and with much reduced risk of overtraining or injury. However, Craig did add, 'Using heart rate monitors, for example, is all well and good, but you also have to remember to ask the athlete, "How do you feel?" You have to use the science but not get too caught up in it.' He added, 'If an athlete says they are tired, that has to be taken into account, regardless of what their heart rate monitor says.' As I indicated in the introduction to this PP coaching special, the 'art versus science' debate in coaching is crucial to producing winning athletes – whatever their sport. This is an ability on the part of the coach that develops with their experience and, as I believe, with their own sports history of involvement as well a recourse to sports science and testing.

Crucially, though, it rests on knowing 'your athletes', what make them tick, what training loads they can handle and what their mental strengths are. As Dave Alred indicated in article 2, you cannot separate the mental from the physical.

It's all about balance

Training middle distance runners requires a balance between endurance base building, and sharpening/speed work. Interval training – of long and shorter durations – is crucial in this respect as is lactate threshold work. While certain goals need to be achieved in training, progressing toward them should reflect an adjusting of the fundamental principles to an athlete's personal needs.

Rowing for gold

Three times Olympic rowing coach and Concept2's indoor rowing guru **Terry O'Neil***, talks to* **John Shepherd** *about elite training and his life in the sport*

John Shepherd: How did you get involved in rowing?
Terry O'Neill: I got into rowing through my father. When I was a kid there were a lot of trades that had rowing sections and the print trade was one of these. My dad worked in the print and his company had a rowing section based on the river Lea in East London. He took me down to the club when I was 10 to learn to cox.

JS: To what standard did you row personally?
TO: I was a part of the first national GB squad that was formed in the early 60s. Until its formation national squad selection had been a matter of selecting the best club crews based on their Henley regatta performances. A serious back injury terminated my career. Perhaps 'career' is not the right word; rowing was still very amateur in those days and involved training in the evenings and weekends everyone had a full time job. Although I did start rowing again when I had recovered (from his injury, Ed) it had to fit around my real career, the one that put the food on the table.

JS: What was the highlight of your coaching career?
TO: There were three and each had a special significance. The first time I was selected for the national squad with a crew I had coached from my local club in the East End… two local boys, no outside support. This made me realise that I did have some coaching ability. The second was coaching the winning world champions, who set a world best time that stood for 9 years.

That's when I learnt that to win you have to have the best athletes. To get it 'right' can be expected, but the scope to 'cock it up' can be enormous. The fear of failure paralyses some coaches and they will not make the tough decisions. You see these coaches around year after year even though their results are crap, but you cannot pin failure on them, because they have not made any decisions, wrong or right… so they get promoted! And thirdly, the first time I entered the Olympic Stadium in the opening ceremony parade in Seoul. This was an emotional highlight. The atmosphere was incredible and I had a lump in my throat the size of an ostrich egg.

JS: Why did you decide to coach?
TO: I was rowing in a club crew training for Henley when I had a car accident and broke my arm. We did not have a coach so another bloke jumped into my place and I coached. When my arm got better I could not get my place back so I was now the coach, the only one in the club.

JS: How has rowing training changed from when you were rowing and coaching to the present day?
TO: When I returned from Seoul, I realised that I could not carry on with a full time job and coaching at Olympic level. When I started rowing, we trained Tuesday and Thursday evenings and Sunday mornings. My schedule for Seoul was, up at 5am travel to Hammersmith for a 6.30 session. Work at 8.30. After work, back to Hammersmith for another session at 6pm. I got home about 9pm, then it was dinner and bed. Weekends we trained at Henley, arrived at 7am and left about 2pm. I spent so little time at home the dog used to bite me.

Athletes were already getting some sports aid funding but coaches were not paid. In the early nineties better funding for athletes and coaches meant the sport turned professional and training volumes literally doubled. In doing so, the intensity altered and the majority of training became low intensity. When I started we used three heart-rate training bands, now there are six.

JS: Do you think that rowers train too hard?
TO: I have just got back from the FISA (rowing's international governing body, Ed) coaching conference in Paris and the three main speakers were all coaches from Beijing Olympic gold medal winning crews. All were very open and showed us their programmes. The most interesting aspect to me was that the coach with the lowest training volume crew attained the highest percentage of the planned programme. There are two key aspects to training: improving performance and avoiding illness and injury. To achieve these you need a coaching team including a doctor, physio, nutritionist and psychologist.

JS: What are your thoughts on base building and peaking (involving anaerobic interval) work for rowing? I sometimes think that rowers should be trained as individuals more of the time, rather than units, and then come together once they have attained peak physiological condition.
TO: It actually takes time for a rower to make the team they have been training for – in fact about 8-10 years. During this period individual training programmes will produce the best results on an individual basis by allowing for the differences you mention. Rowing is a closed skill (not reliant on continuous decision making on the part of the performer, unlike a footballer, for example, whose sport is an 'open skill' one Ed). It is also a co-activity where everyone does the same thing at the same time. The athlete only has to learn one simple sequence of movement, but repeating that 35-40 times a minute for 6 minutes over the 2k Olympic distance challenges every aspect of energy production. Tactics and race strategy play very little part – basically it is all about getting to the front as soon as possible and staying there! Therefore the training becomes very task orientated. We know the physical requirement, so this is why a 'one fits all training' approach is adopted. It is almost a selection process based on the idea of 'the last man standing'. This is what you need to be able to do 'and if you can't hack it close the door on your way out'. However, although physical attributes and condition far

outweigh any other factor, with everyone now on similar full time training programmes, other aspects become significant and attention to detail, and personal differences can determine the outcome of success and failure.

JS: Have there been any significant innovations in rowing training recently?
TO: Different things come in and out of fashion, get repackaged and presented as new, but when you have been around for as long as I have, you've seen it all before! I think that being able to detect early signs of fatigue are vital with the training volumes now being performed by rowers. There is a system where a swab is taken from inside the mouth… this gives an accurate indication of the state of the athlete's training health. I believe this is based on measuring aspects of the immune system, which is suppressed during heavy training. This is a step up from relying on a jump in the resting pulse rate (monitoring heart rate a few minutes after waking, with an increase over 'normal' supposedly indicating an over-trained state, Ed).

JS: How important is weight training to rowing?
TO: This was a key aspect that reflected the different approaches of the three coaches I spoke of previously at the FISA conference. One took the traditional approach. This involved using relatively light weights with high reps on 12 exercises. Another did no weights, whilst the other used the one rep max system as a base for strength training (this involved lifting at heavy loads, with fewer repetitions). Basically there are different approaches.

Go to: http://www.concept2.co.uk/guide/guide.php?article=hour_pain) to discover Terry's specific to indoor rowing 2000m weight training programme.

JS: What is the value of X-training for rowing?
TO: X-training does play a big part in rowing training. Because of the athletes' locations, they may not be able to train together in the boat all the time and also in some countries winter

weather prohibits on water training. The rowing machine is the number 1 cross trainer followed by the bicycle and running for aerobic work, and then weights for strength and power. Northern Europeans also use cross-country skiing.

JS: How relevant is ergo training for rowing?
TO: I believe the Concept2 is fundamental. Because you have removed all the technical aspects of the sport – including weather conditions that have a major affect on boat speeds – you can just focus on developing the physical requirements in a controlled environment.

JS: Any thing else you would like to add?
TO: Many of your readers are not international athletes – who have top coaches working with them – they need to know what type of training is best for them. I believe this becomes a question of the effective use of training time. With more time to train you can identify different aspects of the energy system and train in a very systematic way. But with less available time, it's not a simple matter of cutting down an elite programme, because the integrity of that programme is then destroyed. I have provided an example of a training programme that you can use:

High intensity rowing programme

This training, created by three times Olympic rowing coach Terry O'Neill, covers an 8-month period and is subdivided into three 8-week training blocks. Each block has a specific training aim.

The high intensity programme is ideal for veterans (masters) as their race distance is 1000m – a distance that takes between 3-4 minutes to complete. It is also suitable for 2000m rowers with limited training time and for clubs who normally race over distances less than 2000m. You should see the training programme primarily as a guide – you may find it useful for you as it is or you may have to adapt it to suit your needs.

The high intensity programme will draw criticism from traditionalists who will quite rightly point out that even when racing over 1000m, the sport is still predominantly aerobic. However, this high intensity programme is based on anaerobic sprint training principles and not aerobic endurance. My answer is that although based on sprint training, I have produced a training programme that will still provide good results, particularly with limited training time.

Dispelling some myths

I would like to dispel some myths. Some time ago a research study showed that exposure to high levels of lactate could lead to muscle damage. As a result of this, report training schedules were produced that avoided building high levels of lactate. However, although lactate is an acid and can cause damage (not long lasting and to nerve endings in muscles, for example) we have to keep this in context. The total training time in the programme where high levels of lactate are present amount to a couple of hours a week and this exposure does not present itself as a risk.

All training causes muscle damage, and it is in response to the damage that adaptation in the muscle takes place so that for any given level of intensity this damage does not occur again – basically endurance and/or strength is elevated. But this damage is microscopic in nature and a natural consequence of training and it should not be confused with muscle damage caused as a result of impacts or strains.

Block 1 Weeks 1-8	**Block 2** Weeks 8-16	**Block 3** Weeks 16-24	**Block 4** Weeks 24-32
Training aim/aims			
To develop speed over short distances and increase mechanical efficiency	To improve aerobic capacity, maintain mechanical efficiency and speed (AT)	To develop the cardiovascular system (TR) and increase basic strength. This is achieved by medium distance and intensity intervals plus speed retention	To develop fast strength and lactate tolerance. Specific to race distance and composite sessions from previous 3 blocks

See below for a guide to the types of training required in each block

Key to blocks

MHR refers to maximum heart rate. You'll see these terms used to describe the workouts you should be doing in each of the sessions in the blocks

UT3 50% MHR **(UT3)**	Bursts 100% MHR **(BURSTS)**	Pyramids 100% MHR Pyramids **(PYR)**	Medium intervals 95-100% MHR **(TR)**	Anaerobic threshold **(AT)** 85% MHR
Aim: to improve mechanical efficiency by long continuous rowing. Intensity should not exceed 50% MHR. These sessions increase the oxygen processing capability of muscles in particular	Aim: speed- work using the creatine phosphate (anaerobic) energy system. 10-stroke bursts flat out performed in groups of 100's (10x10), ie 500 strokes = 5 (10x10). Rest between bursts is when heart rate reaches RHR x 2*	Aim: extended speed work using anaerobic system. Blocks of 100 strokes performed as follows: 15-20-30-20-15, rowed flat out equal numbers of light strokes performed in between. 4 minutes' rest between sets	Aim: development of lactate tolerance and lactate metabolism. A series of intervals from 2-4 minutes duration are performed with equal rest between. All at max speed **(TR)**	Aim: develop cardio-vascular efficiency. Series of intervals of between 5-8 minutes duration **(AT)**. Sessions last 45-60 minutes

Further clarification of terms used in the training programme

AT: Training band at the border of where the body switches to producing increasing amounts of energy anaerobically as opposed to aerobically. There is much reduced reliance on oxygen as lactate levels rise despite the athlete attempting to remain at threshold.

TR: These are extremely tough workouts producing significantly elevated levels of lactate. They develop muscles' ability to better combat lactate's detrimental effects on performance.

BURSTS (Creatine phosphate): This training band specifically targets the short-term anaerobic energy system directly. This energy system has very little reliance on oxygen to fuel it and

instead uses stored body fuel sources, primarily creatine phosphate, to supply the energy. The short-term anaerobic energy system supplies energy for up to 90 seconds.

PYR: These longer, high powered stroke intervals will have a greater taxing effect on the anaerobic system than BURSTS, due to the increased number of strokes being performed. These sessions will develop the power endurance of the athlete.

UT3: This training band uses very low heart rate levels (as indicated, 50% of max heart rate, and will not have a very significant effect on improving top end rowing performance directly. However, it will, develop the body's ability to preferentially burn fat as a fuel source (at all aerobic intensities) if included in the rower's training on a year in year out basis. This will spare more valuable carbohydrate stores which have a more limited supply. These sessions are also suitable for recovery and warm down purposes

Block 1 weeks 1-8				
Week No. Intensity	**Day 1**	**Day 2**	**Day 3**	**Day 4**
1 Light	30min. UT3200 bursts	40 min. UT3 300 bursts	45 min. UT3 45 min. bursts	50 min. UT3 500 bursts
2 Medium	60 min. UT3 200 Pyr	50 min. UT3 300 Pyr	45 min. UT3 400 Pyr	40 min. UT3 500 Pyr
3 Hard	60 min. UT3 500 bursts	70 min. UT3 600 Pyr.	80 min. UT3 700 Bursts	90 min. UT3 800 Pyr
4 Light	50 min. UT3 500 Pyr	60 min. UT3 400 Pyr	40 min. UT3 300 Pyr	50 min. UT3 200 Pyr
5 Medium	60 min. UT3 300 Bursts	80 min. UT3 400 Bursts	70 min. UT3 500 Bursts	90 min. UT3 600 Bursts
6 Hard	90 min. UT3 700 Pyr	80 min. UT3 800 bursts	70 min. UT3 900 Pyr	60 min. UT3 1000 bursts
7 Light	50 min. UT3 400 Pyr.	60 min. UT3 300 Pyr	45 min. UT3 400 Pyr	50 min. UT3 500 Pyr
8 Medium	90 min. UT3 500 bursts	80 min. UT3 500 Pyr.	70 min. UT3 500 bursts	60 min. UT3 500 Pyr

Resting heart rate (RHR) recovery

You'll see that some of the sessions have a two times RHR recovery. To work this out you'll need to take your RHR over a couple of days and calculate the average. Therefore the designated recovery is determined by the drop in heart rate until twice RHR is reached. RHR is taken a few minutes after waking.

Block 2 Weeks 9-16

Before AT sessions do a 20min. warm up and a 20min. cool down after sessions, both at UT3
Rest = until your heart rate drops to twice RHR, before going again (see above)

Week No. Intensity	Day 1	Day 2	Day 3	Day 4
1 Hard	2x8 min. AT	3x8 min. AT	2x8 min. AT	90 min. UT3 800 Pyr
2 Light	30 min. UT3 200 bursts	2x6 min. AT	3x6 min. AT	4x5 min. AT
3 Medium	3x7 min. AT	50 min. UT3 300 Pyr.	5x5 min. AT	4x7min. AT
4 high	4x8 min. AT	7x5 min. AT	80 min. UT3 700 Bursts	5x8 min. AT
5 Low	3x8 min. AT	4x7 min. AT	5x4 min. AT	50 min. UT3 200 Pyr
6 Medium	60 min. UT3 300 Bursts	8x5 min. AT	5x8 min. AT	8x5 min. AT
7 High	6x5 min. AT	80 min. UT3 800 bursts	5x5 min. AT	8x8 min. AT
8 Low	3x8 min. AT	4x6 min. AT	45 min. UT3 400 Pyr	3x8 min. AT

Block 3 Weeks 17-24

A 30min. warm up should be carried out before TR and AN sessions. 20min. cool down on completion of the set. Rest between sets resting heart rate x 2.

Week No. Intensity	Day 1	Day 2	Day 3	Day 4
1 Medium	4x3 min. TR	6x2min. TR	60 min. UT3 500 Pyr	4x3 min. TR

Block 3 Weeks 17-24 *(continued)*				
Week No. Intensity	**Day 1**	**Day 2**	**Day 3**	**Day 4**
2 High	4x8 min. AT	7x5 min. AT	80 min. UT3 700 Bursts	5x8 min. AT
3 Light	3x5 min. TR	8x2 min. TR	3x4min. TR	45 min. UT3 400 Pyr
4 Medium	60 min. UT3 300 Bursts	8x5 min. AT	5x3 min. TR	8x5 min. AT
5 High	6x3 min. TR	2x(10x1 min.) AN	80 min. UT3 700 Bursts	6x3 min. TR
6 Low	3x5 min. TR	4x4 min. TR	50 min. UT3 400 Pyr.	3x5 min. TR
7 Medium	6x2 min. TR	8x2 min. TR	90 min. UT3 600 Bursts	6x2 min. TR
8 High	90 min. UT3 500 bursts	4x3min. TR	6x90 sec. AT	6x2 min. TR

Block 4 weeks 24-32				
Week No. Intensity	**Day 1**	**Day 2**	**Day 3**	**Day 4**
1Light	50 min. UT3 400 Pyr	4x3 min. TR	6x2 min. TR	10x1min. AT
2 Medium	10x45 sec. AT	20x30 sec. AT	4x3 min. TR	60 min. UT3 300 Bursts
3 Hard	8x90 sec. AT	10x90 sec. AT	6x90 sec. AT	8x90 sec. AT
4 Light	3x8 min. AT	4x6 min. AT	45 min. UT3 400 Pyr	10x1 min. AT
5 Medium	10x45 sec. AT	90 min. UT3 600 Bursts	8x1 min. AN	6x2 min. TR
6 Hard	90 min. UT3 500 bursts	4x3 min. TR	6x90 sec. AN	6x2 min. TR
7 Light	50 min. UT3 400 Pyr.	60 min. UT3 300 Pyr	45 min. UT3 400 Pyr	50 min. UT3 500 Pyr
8 Medium	10x45 sec. AT	8x2 min. TR	90 min. UT3 600 Bursts	6x2 min. TR

Strength: Building power in the weights room

Tudor Bompa *talks about his approach to strength development which is designed to make athlete more explosive and quicker regardless of their sport.*

John Shepherd: How did you get involved in sport?
Tudor Bompa: This question brings to my mind a mixture of memories: some very good and others reminding me of my failures in my sporting life… Like almost every kid in Romania I started to play football. Track and field also captivated my interest, so much so that during the mid-teens I was very busy training and competing in both sports. I quickly realised that the athleticism I gained from track and field greatly helped my football. I was the fastest and the strongest in our junior football league and by the time I was 17 I was selected for the Romanian national under-18 side. And I still managed to find the time and energy to continue with my track and field training. I won a silver and two bronze medals in the under-18 national championships – these were in the sprints and the pentathlon, so I was busy! However, an unfortunate ankle injury terminated my football career.

Some of my best friends were rowers and with my injury I found myself leaving the football field and track and field for the water. Since I was genetically equipped for speed and power, I had to struggle to achieve a decent performance level in a sport where endurance is crucial. But somehow I managed and kept going to such an extent that I won a silver medal in the 'four' at the 1958 European Championships.

Professionally, I feel that I owe a great deal to my own sports involvement. For example, the character sports builds and the

perseverance. I think that without the knowledge I gained from tens of thousands of hours of training and coaching I would have never reached my best as a professor, a sports training specialist and author.

JS: Why and how did you get involved in sports science?
TB: I realised that I lacked a great deal of scientific training knowledge. Therefore, for several years I read everything I could put my hands on. And this was in a Communist society where access to information was available to only a selected few. At this time I was coaching rowing and track and field. I was having success with the javelin event and I was invited to coach the national rowing team level. From that point on I had access to everything I wanted, including the chance to research many of the training elements that have captivated me. For example, strength training as it applies to different sports and the development of endurance. This was happening in the 1960s and these were the years that really shaped my professional training philosophy.

JS: Was there such a thing as a sports science revolution?
TB: I would say that if we really have had a revolution in this area of sports science and the methodology of training, then this was in the 1960s in East Germany, Russia, Romania, and the other Eastern Bloc countries.

JS: You are widely acknowledged as one of the fathers (if not the father) of periodisation do you accept this tag and what made you interested in this field?
TB: Your statement greatly honours me, but it is slightly exaggerated. Let me share with your readers the evolution of periodisation. From the early years of the ancient Olympics, athletes have followed a very simple but logical method of training. They train to compete; compete in pre-Olympic and Olympic Games and then rest and relax. This is periodisation – the athlete follows training phases (now called preparatory,

competitive and transition phases). In fact this was described by the Greek philosopher, Flavius Philostratus (AD 170-245). This man deserves a great deal of respect for his 10 books on athletic training, many of which have been destroyed by the passage of time. Planning, therefore, is neither a novelty – nor a Russian –discovery. However, a Russian professor, Leonid Matveyev was the first to use the term periodisation, in terms of planning the phases of an athlete's training. He borrowed the term from history, where periodisation describes the phases of human history, that's to say antiquity, middle ages and so on.

Matveyev was the first author to really analyse statistically what the Soviet athletes used in training for the 1952 Olympic Games. His work and conclusions validated the concept of periodisation as used from 1896 to the present. That is that the annual training plan should be divided in phases of training, each phase having a specific training objective (mostly physiological). And that the phases of the annual plan should be subdivided into even smaller training phases called 'macro-cycles' (of 2-6 week's duration) and 'micro-cycles' (a week of training).

It's funny looking back on my time then, as the Russians wanted to steal everything that had been successful in any of the eastern European countries. So much so that in the West it's often thought that the Russians discovered everything in training! Mind you, in this case, Matveyev did a great deal.

JS: What's the difference between the periodisation methods that evolved in the fifties and those of the present day?
TB: The difference between periodisation in the 1950s and what is widely accepted nowadays is that 1) we have created several variations of periodisation and 2) in our planning and periodised training we apply sports science more effectively. With research and through the efforts of top coaches we constantly discover/produce better information that enriches the science of training.

JS: How did you and your colleagues analyse whether periodisation worked?

TB: Many elements of periodisation have evolved as a result of a better understanding of sports science or through research at the Romanian Olympic Training Centre in Bucharest and Timisoara. It started when we tried to work out why our athletes failed to reach peak performances in the most important competitions!

In 1963 Mihaela Penes, a junior javelin thrower from Romania was left without a coach when she moved to another city. I was approached to help her. I applied what is now known as the 'periodisation of strength' to her training. At that time nobody regarded maximum strength ('MxS') as a key determinant of power.

'the ability to produce power depends on how many FT fibres are recruited into action and how quickly the contraction of the muscles performing the athletic action occurs'

The logic of the time and one that is still held by many coaches today, was that since power is the dominant ability in the javelin, as an example, power has to be trained all the time. However, my logic was different. Since power is a function of MxS you have to develop MxS first and convert it into power, prior to participating in major competitions. Many coaches have ridiculed me for training MxS – they said that, 'MxS will make you slow'!

However, the knowledge we now have in exercise physiology justifies what I believed and believe in. That is the scope of MxS to recruit more fast twitch (FT) muscle fibres. This contrasts with power training that increases the discharge rate of same muscle fibres. During the first winter with Mihaela I tested my theory and realised that levels of power were much higher with the periodisation of strength, as opposed to other athletes who followed the standard training methodology of year-round power training. In other words, the ability to produce power depends on how many FT fibres are recruited into action and how quickly the contraction of the muscles performing the athletic action occurs. This combines maximum recruitment with maximum discharge.

My thoughts were vindicated further by my practice, as Mihaela achieved outstanding testing results and a national

senior record. She was only 18 years old at the time and the record was in her first outdoor competition! Her improvement (over 9 metres in the first year) continued steadily for the following one and a half years.

Since Mihaela was an unknown athlete outside of Romania I wanted to surprise all her competitors at the Tokyo Olympics in 1964. I added another different ingredient into the training plan. This was where the first attempt had to be the best of the day in both throwing and strength-power training. We did this for almost two years. In Tokyo none of the other throwers were looking out for her and with her first throw she threw an Olympic record! Shock! All the other throwers had long faces! And they still did by the end of the competition as she climbed on the podium to collect her gold medal!

JS: Tell us more about your thoughts on weight training
TB: The best way to answer this question is to show the relationships between strength and other motor abilities. During an athletic action such as sprinting, the athlete invokes a certain number of fast twitch muscle fibres – the higher the number, the greater the ability to display both strength and power. Let's assume that athlete 'A' can recruit 60% of all their FT and athlete 'B' only 55%. Who has the probability of displaying a higher level of power?

Please remember that according to the periodisation of strength model, maximum levels of power can be reached only after the MxS phase. In other words the periodisation of strength is organised in this sequence:
1. Anatomical Adaptation: 3-6 weeks
2. MxS: 6 weeks
3. Conversion to power: 5-6 weeks

JS: You said there are different periodisation models…
TB: Double, (two peaks), and triple (three peaks) periodisation models resulted from detailed studies. In the 1960s most athletes used a 'mono-cycle', or one peak annual plan – this used to be a typical in track and field. I also used it in rowing. It

soon became apparent that the best performance was achieved in early summer (June) and could not be replicated in the late summer (August) during world championships, for example, with these methods. This failure made me critically analyse what I was doing with my athletes. More testing and research followed and I finally realised that for sports where a coach has to plan two peaks per season he/she has to use a plan I called, at that time, double peak periodisation.

Between the first peak in the early summer (June) and the second in August, as examples, I had to put in mini preparatory phases (involving mostly MxS and power training). A very short transition period was also included in June at the end of the first peak – this lasted for two weeks. The result was two World Champions in the next year in rowing.

This variation of periodisation evolved into what I now call a 'bi-cycle or a double peak annual plan'. Since these changes in periodisation proved to be very successful, the Romanian national coach for the jumping events asked me to analyse his annual plan. He had also experienced the same situation as me, in regard to poor late season form. I concluded that the reason again revolved around strength training. Normally, during the winter months strength training is an important training element in the jumping events. However, as soon as athletes start competing outdoors, specific technical training becomes dominant at the expense of strength and power training. So I recommended that a mini strength/power training phase for the second peak should be included. This proved successful and has brought to Romania many medals in the World and Olympic Games.

JS: You've had your detractors…

TB: Yes, despite the success of my methods I have my detractors, especially in the USA. Several sports scientists have claimed that I didn't really create all the elements of periodisation I have described in my books. They claim that the Russians developed them! And that I 'just' brought them to the West! My reaction to this is 'Show me a Russian book or

article written from 1960-1980 that discusses periodisation of strength/power, or the periodisation of endurance, speed and agility and so on'. In fact two books of mine have been translated into... Russian!

JS: Your books have sold over 650 000 copies, so your methods are now worldwide

TB: Well, yes. My methods have been used by many and here for example, in Canada, with Canadian rowers and some sprinters (Tudor has lived in Canada for 37 years). I adapted the same periodisation of strength methods I used for Mihaela for Ben Johnson, working with his coach Charlie Francis. Francis, agreed with the MxS training I suggested for Johnson. Remember that this was in 1983, when strength training for sprinters was believed to slow them down rather than assist them in applying more force against the ground. I produced the following plan:

I began with what I call 'anatomical adaptation' – this lasts 3 to 6 weeks. I then planned a MxS phase for 6 weeks. This was followed by a power training phase. Both MxS and power training is then maintained during the competitive phase. Charlie and I demonstrated in the 1980s that a sprinter can never be fast before being strong!

JS: I've read your endurance strength ideas using 400 plus reps

TB: With rowing I developed another version of periodisation. This was developed in the late 1960s to 1980s. This involves a 6-week MxS phase, followed by a muscle-endurance phase ('M-E'). This lasts for 8-10 weeks. While the specifics of MxS is to use heavy loads (over 80% of one repetition maximum), during the M-E phase the athlete is trained with much lighter loads (30-40%) 1RM. Sessions often use more than 400 repetitions (8 exercises x 60 repetitions per muscle group). These are performed non-stop, but they do alternate muscle groups to allow for a better rest and recovery. This training will stress the heart and lungs in a way that is commensurate with the specifics of the athlete's (endurance) event.

JS: Has periodisation theory changed significantly? There have been a number of articles recently touting 'the end of periodisation'. These, to me, just supplant linear periodisation with undulating periodisation (UP)

TB: I read such an article myself and was very disappointed to realise the author confused loading patterns with the periodisation of training! Anyway, for those who claim the end of periodisation, I have two questions/comments to make: a) do they really understand periodisation? I regret to say this, but the more a person questions periodisation the more I question his/her understanding of sports science and training. In general. Let me simply say that for as long as you want to be an effective coach you have to be well organised, and conduct a well organised and planned periodised training methodology. And b) if periodised training is ineffective what is left to us? We either have periodisation or chaos! Chose what you want.

'Let me simply say that for as long as you want to be an effective coach you have to be well organised, and conduct a well organised and planned periodised training methodology'

JS: And … undulating periodisation?

TB: So-called undulating periodisation is nothing but a change to the patterns and magnitude of training loads during a week of training. Olympic weightlifting athletes have used variations of loading patterns for generations. Since the sixties the variation of loading magnitude per week has also been used in most sports, matching strength training intensities to the intensities planned for specific training days (days with low, medium or high intensities). This is better expressed as alternating training loads as a percentage of 1RM.

Now, I don't want to be arrogant, but it seems to me that some authors want to recycle the loading pattern format as discussed since the 1960s and pretend they have created something new! And in any case the more variations of loadings during the week (ie 60-70-80-90% 1RM) the more I question the effectiveness of adaptation to a given load. For instance to increase MxS one has to use loads greater than 80% 1RM. Any time you lower the load to less than 80% you don't develop MxS any more, rather you create a variation of power training. So in reality UP is nothing else but a stew. A mixture of

ingredients, or in our case, a mixture of training loads that will result in mixed adaptation. A little bit of everything is not really conducive to optimum adaptation.

JS: What about new systems and approaches?
TB: We live in a time when novelties in training are scarce. We end up with gimmicks. Look at the books published in USA about balance training, stability ball core training or the exaggerations about the importance of stabilisers (core muscles).

Certainly, I don't want to minimise the importance of the stabilisers or the need for the development of the abdominal muscles as a support for certain moves. But I resent circus-like exercises, such as standing on a stability ball and throwing a medicine ball to a partner. I believe that this will never improve the ability of an athlete to throw the ball further as a demonstration of improving power. In reality, if you exert the same action with the legs on the floor you can develop power more effectively.

'I resent circus-like exercises, such as standing on a stability ball and throwing a medicine ball to a partner. I believe that this will never improve the ability of an athlete to throw the ball further'

One more comment about the development of core strength. The abdominal muscles contract more forcefully during squats than during many core strength exercises. This is validated by EMG testing. Why all these gimmicks? Simple: the sports and fitness industry has to sell, sell and sell! Profits seem to be more important than honesty. The sports equipment industry, the catalogue companies and the poorly trained instructors promoting them don't really care what works and what doesn't.

JS: How close are we to reaching the buffers of human potential in quantifiable sports?
TB: These types of questions have come up from time to time for many decades. And yet every time somebody says that we are close to reaching the maximum of human potential, superior performances are constantly reported. Personally, I don't want to venture into any types of predictions since:
1) Athletes with superior genetics are constantly found and in many cases athletes are selected scientifically

2) Training methodology improves constantly
3) Training effectiveness increases proportionally to the coach's improvement in training knowledge, in the area of planning-periodisation
4) For speed-power sports many coaches have learned about the benefits of MxS for the development of power, agility and speed, thus performance will improve
5) In endurance-dominant sports coaches have learned that specific endurance is better trained via shorter, but more intensive training

JS: Are you still coaching?
TB: Not really. I stopped coaching in 1987 after Ben Johnston's tragedy. However, I have worked as a consultant to several athletes and teams. I have also spent lots of time lecturing and writing. Not too much in Canada since I have been at odds with the Canadian sports bureaucracy.

JS: How did you get to Canada?
TB: I have lived in Toronto for 37 years. In 1970, I managed to escape communism. I have been teaching and researching at York University for 31 years. In the first years it wasn't easy, mostly because of my poor English, but also because of the cultural shock. Another shocker for me was the large discrepancy between training methodologies we used in Romania and the rudimentary level (at that time) in Canada and its coaches.

JS: What have you found on your travels?
TB: I have lectured in over 40 countries, sharing my thoughts on sports and fitness training. What is very frustrating to me is that the application of science to training comes in slow motion.

JS: Your thoughts on strength and power training (as you mentioned) are contrary to North American methods in particular. Do you experience resistance to your thoughts?
TB: Top coaches, especially those from track and field, have

accepted and used many of my training concepts. In other sports, such as football, ice hockey and baseball, most coaches follow their own traditions, very often, contradicting sports science. Many team sports coaches have a very limited understanding of basic exercise physiology. Sports science has a hard time penetrating through the thick veil of traditions of some sports.

Also, American strength training has been influenced by body-building. Amazingly, large muscles are still equated with power. The theoretical knowledge and training methodology in strength training is often quite shallow. Many coaches are confused regarding the best methodology for increasing strength and power and what actually works and what doesn't!

JS: Is there truly a 'key' weight lift for a power athlete, such as a sprinter? Recently I read an article where the dead-lift was identified by one coach.

TB: For sprinting and any sports that desire quickness, maximum speed and agility, the triple extensor muscles (gastrocnemius and soleus, quadriceps, and gluteus maximus) are determinant for ultimate performance as the propulsion phase (the push-off against the ground) when sprinting is crucial. Weak propulsion potential will increase the duration of the contact phase, making the athlete slower. The stronger the triple extensor muscles, the shorter the duration of the contact phase. A short duration contact phase means improved speed. Now, the dead-lift does not strengthen the calf muscles! Period! It strengthens the hamstrings – which are essential in terms of power and strength in terms of shortening the recovery phase of the running step (bringing the heels up toward the buttocks).

I recommend these exercises for sprinters (and any athletes) that want to become faster and more agile (in this order):

a) Calf (heel) raise.
b) Squats
c) A lift that strengthens the hamstrings, eg leg curls

I apologise for my bluntness, but it seems that every now and

then some coaches do 'rediscover the wheel'. Every time an athlete achieves a great performance the trend is to find out what their coach has done. To ask what the miraculous lift is. However, nobody asks about the genetic qualities of the athlete or how the coach has planned the different phases of the training programme. But there are no miracles when it comes to strength training for sprinters.

'nutrition must be adapted to the dominant energy system of a given sport and the time in the periodisation plan'

JS: What do you think about sports-specific strength training in the UK?
TB: I believe that strength training for sport in the UK still has a great deal of soul searching to do. On my last trip to the UK in 2006, I realised that strength coaches in the UK are too captivated by Olympic weightlifting. Why? Don't they know that a strength exercise should be selected in regard to targeting the muscles in the relevant way they are used in the sports activity itself? If this is understood then simply select the moves that target the specific muscles and train them. Forget about Olympic lifts!

JS: You've also explored the periodisation of psychology and nutrition. What's this all about?
TB: Training is a very complex endeavour; simply because human beings are complex individuals. There is so much to account for to successfully train an individual.

For example, you need to train the energy systems in correct proportions and this has a knock-on effect on nutrition. For example, during the MxS phase more protein would be needed. Therefore nutrition must be adapted to the dominant energy system of a given sport and the time in the periodisation plan.

The development of certain abilities also requires specific psychological support. For instance, maximum concentration is a crucial psychological quality during maximum speed, power and MxS training. We use some very selective psychological strategies and adapt these techniques to the training phase, training methods and the needs of the athlete.

JS: Tell us about the 'Tudor Bompa Institute'. What are its aims and objectives?
TB: Being a professor for many years I wanted to continue what I have been doing. The popularity of my books and the positive feedback I constantly get from my students and readers encouraged me to develop the Tudor Bompa Institute (TBI). Therefore, the TBI offers several certification programmes where my books are used as course materials.

JS: What makes a successful coach?
TB: A few simple comments – have an inquisitive mind. Experience as many methods as possible to realise what works best. Beware of salesmen. Always challenge instructors promoting 'novelties'! Read, read! and read again! You'll find out what is good and what is ...trash!

Oh, and read my books. They are the best in the world, but if one evening you find it hard going to sleep, just open one and in a few seconds you'll be gone!

Bompa has written 15 books and these have been translated into 18 languages. They have sold 650000 copies worldwide.

As a coach in Romania he coached numerous top athletes including the 1964 Olympic javelin champion Mihaela Penes.

He is the only coach who has produced Olympic and World Champions in two different sports – track and field and rowing.

To find out more go to: www.tudorbompa.com

Speed: How to be quicker for all sports

Peak Performance talks to speed training expert **Margot Wells***, about rugby, British sprinting and her daughter following in her husband Allan's (1980 Olympic 100m champion) footsteps*

John Shepherd: Has sprinting changed since Allan's days?
Margot Wells: I don't think it has changed. I mean the gun goes and whoever gets to the line first is the winner! No seriously, I do know that Allan's training was seriously flawed. Tracks have also got faster. Allan was never one for going somewhere to get a fast time – he was more concerned with beating everyone who was running. Major medals were a major part of his psyche.

JS: What about coaching your own daughter?
MW: Well, my daughter Zoe, at the age of 22, decided that she wanted to be a sprinter – with no background of sprinting at all. So if I pull this one off I'm better than what I thought. But then she's got her father's head. So she wants to see how good she can be.

JS: What's your sprint philosophy?
MW: It's to make the sum of the parts equal to the whole. At the moment Zoe is strong, she's 6'1", but I have not had time to join those parts up. And so you don't get the consistency. I spent a year realigning her, so she hopefully doesn't get injured as much as she might. All that knowledge I never had way back then (working with Allan). When I was with Allan I was 27 and swinging by the seat of my pants, now I'm a lot more confident and I know you have to be patient. I know the outcome of every session. It's not guesswork. It's planned.

JS: What about the current athletics coaching system?
MW: I think there should be a system that identifies whether the coach is good enough for the athlete – if they're not, then get the athlete another coach. And if the athlete is not good enough for the coach, find the coach athletes who are. Move things around, but not for the sake of it.

JS: Have you coached athletes from other sports?
MW: Yes, I have coached hockey players and even fencers in the past, as well as rugby players. If the sport involves speed and power I can develop it.

Most sport in the UK is over technified and under fitted. The athletes aren't strong enough to cope with the demands of their sport. Look at our cricketers, our tennis players. The body will break down and it's my job to stop it breaking down. Tennis players will spend so much time working on their forehand or backhand, but if someone fires a forehand at them at 100mph and they've got to turn around and get it, and they can't… well, if you can't sprint fast enough to get it (the ball) then there's no point!

JS: How did you get into coaching rugby players?
MW: By default… London Scottish asked Allan to work with the players and I went along to help. Allan kept disappearing with the bobsleigh team and it just became the norm. This was in 1988. I worked with them for three years. I then did bits with other clubs, such as Alton, when I was bringing up my family (Allan and Margot have a son Simon as well as their daughter Zoe).

I then got totally disillusioned with coaching and I didn't coach for a while, and I didn't really miss it. But then I began to get contacted to coach (rugby) players. I was asked to work with Dan Luger (former England wing) who was with Harlequins, although he was at Surrey University at the time. And it just kind of snowballed from there. I developed a reputation for making people run fast, which I find quite insulting, given the spectrum of things I actually do, but I can see why I have got that tag.

JS: Which other international players have you worked with?
MW: Initially, I had Luger, Lawrence Dallaglio, Kenny Logan, Andy Gomersall, Nick Greenstock, Matt Perry … there was about a dozen of them. I now work with Paul Sackey and Danny Cipriani, for example.

JS: Is the speed required for sprinting different to that required for rugby?
MW: The key difference is that you can't fine-tune a rugby player as much as you can a sprinter. Rugby players' speed in a way is almost capped, but they still run fast. You can make a sprinter's body, but you can't make a sprinter's head. You can't buy that. And I always say, 'who's going to run around for 80 minutes and get their head smashed in if you can run 100m in 10 seconds in a straight line?' I wind the rugby guys up …. only God's gifted get to be sprinters!

JS: Have you developed a system?
MW: Yes, there is a system to how to make people run fast. There are realignment exercises that players and athletes have to do. Just by seeing someone run, every weakness in their body jumps out and hits me. And this says, 'fix this, fix that'. There are key areas to work on. For example, if you don't make the person strong, you'll not get speed. But there is a difference between making them just strong and strong for speed. It's strength for speed….

JS: You've developed your own speed development package?
MW: Yes, it's called 'Wellfast' and it's designed for teachers and coaches to get people to run faster. You don't need a sports science degree it uses a simple step-by-step approach to get people to run fast. It's something that I've wanted to do for a long time.

JS: Does it involve speed-balls (a key part of Allan's training regime)?
MW: Speed-balls will be part of the Wellfast programme. There

is no injury risk, (but) the speed-balls in this country are too big and too slow, so we get ours from Australia. Speed ball training is a great competitive exercise, my guys (the rugby players) will text each other and ask about how many times they hit it in a specific time. It's a brilliant form of exercise.

To find out more about Wellfast go to: www.wellfast.co.uk
E-mail: MargotWells@wellfast.co.uk

Sports specific: Making fitness a hit with cricketers

Nigel Stockill *was the England fitness coach for over seven years and travelled the world, with the likes of 'Freddie' Flintoff, Michael Vaughan and Kevin Pieterson. He agreed to put* **John Shepherd** *through his paces in order to discover just what it takes to play the modern game.*

Research indicates that players walk, run and jog 10-12km whilst fielding in Test matches. That's about the same distance as a footballer. OK, football is played at a much higher intensity and matches last only 90 minutes, but cricket is often played in extreme heat and a batsman could have been fielding all day and then have to face 100mph deliveries in the final session of the day. Fitness does count. Nigel explained that his aim as the England cricket fitness coach was to ensure that a bad ball was never bowled by a bowler, that a batsman was never dismissed or a catch dropped by a fielder or wicket-keeper because of a lack of fitness.

I took part in a specific cricket circuit at the home of the game, Lords, in the indoor school. Nigel explained that the circuit was designed to cover all the physiological and playing aspects of the game. It included exercises to reduce injury and strengthen areas prone to problems – such as the rotator cuff of the shoulder and the lower back for bowlers. The circuit could be used and adapted by cricketers of all levels and could be performed by a squad. I was monitored throughout the session to see how hard I was working – and the results showed that I was achieving very high heart rates throughout.

The circuit

1) Skipping

The circuit kicked off with 30 seconds of single and double leg skipping. The idea was to develop 'fast feet', agility and leg power and get heart rate levels up.

2) T press-ups

This exercise was included to actively work the core as well as the shoulders and chest. This exercise combined a normal press-up with a side plank with rotation – 5 to the left and 5 to the right. The press-up was performed in between each rotation. I found the exercise relatively easy, but it was only the start of the circuit.

3) Run throughs

Nigel must have heard my thoughts, as next I had to do 5 progressive acceleration runs over 50m, with only a turn around recovery – that's basically none! This was very taxing. Nigel explained that this was an exercise that was particularly relevant to bowlers.

4) Rotator cuff exercise

After 30 seconds' recovery, which I was very glad of, it was on to a unique exercise designed to strengthen the rotator cuffs of the shoulders. Using a dyna-band the exercise was performed by completing a short, lifting movement. The dyna-band is held under the feet which are shoulder-width apart. Holding the dyna-band with arms extended in front of you, parallel to the ground and palms facing down. Keeping upper arms in position raise the band towards your head. The exercise was done for 30 seconds. The relatively small movement soon had the tiny muscles around the shoulder joint aching. Repetition of this exercise could reduce strain to this region.

This is an important consideration for coaches – we should manage not only the muscles that will provide power, but also others (and the same ones) in a way that will reduce injury potential.

5) Bat runs
Next up it was time to grab a bat and sprint between the wickets. I ran, 1, 2, 3, 2 and 1 lengths (22 yards) with just a walk back recovery between each effort – bat in hand of course. This was a tough drill and pushed by heart rate back up again to near maximum.

6) Balance and turn drill
With legs beginning to feel heavy, I now had to perform a precision drill using a floor ladder. This required a hop through 90-degrees through each rung. Each landing had to be held, preferably without touching the ground with the non-hopping foot. Nigel explained that the drill was designed to develop balance and kinaesthetic (body) awareness. I performed two versions on both legs – the first required just the hop and turn and the second a reach forward with the opposite hand to touch the grounded foot's toes. This really tested both balance and thought processes, and on tired legs was far from easy.

7) T-drill
Four cones marked a T. I had to run to the mid-cone in the T, drop into a squat type position and then sidestep to the left cone and them across to the right end cone, back to the centre and then back pedal to the starting cone. This drill was repeated twice. Nigel explained that there were numerous variations of it, for example, turning round the cones at the ends and having to catch a ball/balls at any time during the drill. Obviously the players would be made aware that this was going to happen and would need to concentrate on both their agility and the need to make the catch. Again, with fatigue creeping in all skills are likely to break down, but it was explained that the circuit was designed to reduce this potentiality in match situations as much as possible, by creating a very sound base of fitness.

8) Lunge 'with hit' using dyna-band
This was another unusual exercise. A dyna-band was attached to one of the nets and I stood parallel to it, about a metre out holding the bat's handle with a two handed over-grasp grip. To

perform the drill I took a large step forward to step into a lunge and then had to pull the dyna-band across my body to advance my arms to a fully extended position. This drill required core strength as the pull of the dyna-band pulls you off balance. This is particularly so when stepping forward with the left foot, which means you are pulling against the braced position. The exercise was performed for 30 seconds.

9) Run throughs
As before – but by now with the accumulated effects of the session I was looking forward to 'drinks'.

10) Fit ball roll out
This was a familiar core stability exercise. With forearms placed on the ball, I extended my body to push the ball away. This resulted in a bridge-position. I them pulled the ball in by crunching my abs. The exercise was performed for 30 seconds.

11) T drill
As before.

12) Squat and shoulder lift with dyna-band
The exercise was designed to open the shoulders, at the same time strengthening and stretching them. The dyna-band is held just beyond shoulder-width apart, with arms parallel to the ground. I then had to squat and lift the dyna-band up and over my head at the same time, whilst stretching it. The exercise was not taxing from an endurance point of view, but more so from a flexibility and balance one. With repetition I began to get a feel of what was required. Again, 30 seconds was spent on the exercise.

13) Between the wicket runs
Bat in hand I had to sprint, but this time over only 5, 10 and 15m distances, which placed a greater emphasis on the turn and acceleration part of the run. The exercise was performed 3 times with about a 10 second walk recovery between efforts. The shorter distance meant that my heart rate was thankfully

not nearing explosion point, as I had what I thought was the most taxing individual exercise to finish with.

14) Nine ball pick up

In the warm up when Nigel had shown me this drill, I was both looking forward to it and dreading its inclusion at 'number 11' (well, really number 14 in the circuit, but you'll know what I mean). Nine balls were placed on cones evenly spaced about 1m apart to make a grid, with a further line of cones by the start position. The drill was started and finished from the right hand corner (as a drill on its own, it would be performed from both corners in order to develop turning ability to both sides). I ran to the first cone and ball in the first line, grabbing it and returning

The physiological basis of cricket

It is difficult to provide analysis of the physiological requirements of cricket, unlike, for example football, where matches last 90 minutes and all players, except the goal-keeper, perform similar amounts of running, jumping and turning. Cricket has Test matches lasting 5 days and '20-20' games lasting a couple of hours. In the former, a player may not be involved in the action for long spells, whilst in the field or when waiting to bat, but in the latter they may be on the go virtually all the time and have only moments to wait before they are taking guard. Then there are the playing positions – a batsman could be batting for 5 hours or be dismissed in 5 seconds. A fast bowler could bowl 6 over spells, with all deliveries over 90mph, or a spinner 20 overs, bowling at nearly half this pace. The game has so many facets. However, there is a common maxim that runs across all sports and cricket, and that is the fitter the player, the better they will be, everything else being equal. So a cricketer who works on his or her speed, endurance, agility, strength and power will be a better player.

Australian researchers wanted to assess just how much spells of fast bowling affected bowlers (*). Six first-class bowlers bowled 2 x 6 over spells separated by 45 minutes – as might be the case in a match. Ball speed, running velocity over the last 5m of the run-up and accuracy, for example, were measured, It was discovered that there was little difference in performance between the two spells of bowling, although a slight decline in speed over the last 5m of the run up, especially for the faster bowlers in the survey, did create a slight deterioration in delivery speed. This led the researchers to conclude somewhat obviously that being well conditioned was key to preventing bowling deterioration. But that is the point, the fitter you are as a cricketer the better chance you will have of, for example, taking a wicket, scoring a century or making a catch.

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it to the start position, by placing it on one of the cones in that area – then onto the second and back, third and back and so on. After about 4 pick-ups my legs were burning, as were my lungs. It was necessary to keep low and make very dynamic stop-start movements and this was very taxing, especially after all the exercises that I had previously performed.

Interview with **Nigel Stockill**

John Shepherd: Tell me a little bit more about the circuit….
Nigel Stockill: As I said, it would cover all players' needs, assuming everyone was looking to contribute to all three aspects of the game, batting, bowling and fielding. You could use the circuit for general fitness, but you could also use it as a diagnostic tool. You could put an individual through it, and with the help of video, look to identify weaknesses and areas that need working on. And then we could individualise training programmes.

JS: When would the circuit be used?
NS: It can be used in-season and pre-season because it covers all areas of the game. But you would alter the duration and the intensities of the exercises. You can change what you do between each exercise in terms of whether you do real short, sharp speed orientated work or more intense duration work.

JS: Moving on to other aspects of cricket fitness what would be an individualised strength programme?
NS: It would depend on the level of the player, but it may well be some Olympic lifts and some more focused glute, hip and core conditioning that's specific to the individual, where you are looking at preventing a recurrence of an injury or an injury occurring in an area that you or a member of the medical staff have identified as a weakness.

JS: Are cricketers serious about their fitness?
NS: When I first started in cricket fitness, it was more about 'sales'… very much about trying to sell the idea that fitness was necessary

and how it would improve a player's game, so that you could bat and bowl for longer, recover quicker and extend careers.

Over the seven and a half years that I was involved it became more consultative (paraphrasing the players).. 'Right, I know that I need to be fitter, I need to be stronger and more agile and my skills more repeatable ….tell me how.' It's now pretty much accepted that the better players are the fittest players; they can repeat their skills more consistently.

JS: What's it like conditioning at elite level?
NS: At international level the last thing that you want to think about, when players are really under duress from the cricket side of things, is developing fitness. You need to get them (players) fit and then all you need to do is just tinker with their fitness and top it up every now and again.

JS: So it's about maintenance then?
NS: Yes, you can do more, the more solid the base is. If you have a good foundation then you can do a lot, but they will only be little things. If you have a low base of fitness it will be very tiring to develop it…the irony being that the fitter players are actually able to do more and are able to train better and fine-tune their bodies.

JS: How do you work with the cricket coach and fit in conditioning work whilst on tour?
NS: I think that as a trainer you have to sometimes throw away the text-book and forget the science of it… if you only have 10 minutes at the end of a session, then 10 minutes is what you have got.

JS: How scientific is fitness in cricket?
NS: If you can combine heart rates with GPS data, so that the distance and speed at which players move is analysed, then you get some real time/motion analyses as to how hard they (players) are working and in what areas. Then you can really do specific stuff that is going to improve their top end.

SIMON THADANI

Football coaching – Testing times

Ipswich Town FC conditioner **Simon Thadani** *talks about the role of testing in the pro game*

I have had the privilege to work with several top managers and coaches. I have also talked to many other conditioning coaches, managers, football coaches and visited several other clubs over the years, and many of them have different opinions on testing players. Some were not convinced about the benefits, whereas others would be, and would have a whole battery of tests in their repertoire. And then again, there would be clubs that perhaps used only one or two tests.

Basically, the extent of testing and monitoring usually reflects the manager and coaches' philosophy on how players should train and play, and how their condition should be measured. Conditioning coaches will also try to educate managers on the importance of having some measurable standards in place to back up/confirm what they see in training and games. My opinion is simple: testing is important but it should be kept simple and, just as crucially, should be specific to the game. Testing is not only evaluative, but also educative – the players will learn about the importance and the benefits of being tested (ie so that they can strive for higher levels of condition). Testing is also an objective way of confirming the manager/coaches' thoughts.

'My opinion is simple: testing is important but it should be kept simple and, just as crucially, should be specific to the game'

What tests should you do?

Several years ago I went to a course run by the Football Association. There were around 20 conditioning coaches in attendance from the Premiership and the Championship. The

tutors asked us to compile a list of the tests we do at our clubs – both past and present. Most of us were expecting maybe a total of 12 to 15. When the combined list came back, there were 30-plus tests, several of which myself and many others had never heard of! The point I am trying to get over is that there are so many different opinions in the game regarding testing.

Football is a multi-directional and multi-paced explosive game, primarily anaerobic, but with an aerobic foundation. We should therefore test for those components more specifically as aerobic endurance, speed, agility, power and recovery rate.

Difference between professional and amateur players

Subject to your standard of play, you are looking at (subject to the tests used) a difference in fitness of 10% to 25% between amateurs and professionals. However, you should be less concerned with this variance and more with past testing history. This will give you a better indication of fitness levels and the effects of the playing and conditioning programme.

Testing is important for the following reasons:

- To assess fitness levels
- To set programmes and schedules

Testing amateur players

When testing amateur teams, ask yourself two very important questions: how much time does the team have to train, and why does the team play? If your team plays Saturday to Saturday (or Sunday to Sunday) and does not train between games, then it will be very difficult to test players, therefore testing might not be feasible. This is because you will not specifically be working on developing improved football condition. If your team plays for the fun of playing and the social side of football, then I think testing is not relevant, it's important that players continue to enjoy and love the game. However, if your players are more serious and regular training does take place, or they are at a higher level, then testing becomes more relevant and appropriate.

- To study the effect of training programmes and matches
- To turn weakness into strength (team and individual)
- To motivate players and give them objective feedback
- To educate players
- To assess rehabilitation work and post-injury condition
- To create future standards and a player condition database
- To monitor over-training
- To advise the manager of any issues
- To make better players
- To give players the confidence to perform well
- And finally – and often highly underrated – for the mental benefits of telling a player they look good and are fit.

A very practical look at monitoring and testing, based on my opinion and experience

Generally speaking, what follows are examples of what professional clubs (subject to financial status) would monitor in training from Mondays to Fridays. They may use one or more of the following:

Heart rate monitors

If you are looking to improve a player's aerobic fitness, research indicates that you need to work them three times a week for 16-20 minutes in the top heart rate zone, ie 90% to 95% of heart rate max. Heart rate monitors are widely used in the professional game.

Resting heart rates and questionnaires

Measuring players' resting heart rates (RHR*) and using a questionnaire ('Perceived training loads') designed to measure the way the player is feeling about their physical condition, can evaluate training status and inform the coach as to whether they need a rest or some lighter work, or are OK to carry on at the current intensity. Some clubs use this system, but in my experience it is more widely used abroad. You need to trust your players because they can manipulate the questionnaire answers!

* RHR is taken a few moments after waking. A variation from the 'norm' can indicate that the players are in an over-trained state. Note Terry O'Neil commented on the use of swabs to test the immune system of rowers – it is important for all coaches to find out what testing is available to them.

Omega wave system

Only a couple of clubs have this system, due to its cost. It measures the time between heartbeats over several minutes – which in theory, using past history, would give you some feedback on training status.

'The average professional player's VO2max is approx 60ml/kg/min (this indicates a high aerobic capacity on a par with a male elite 400m runner, but allows for a significant anaerobic contribution to their 'energy system power')'

Laboratory tests

The only two lab tests I would use would be the VO_2* test, which measures a player's maximum aerobic capacity, and possibly the Wingate test*, which measures anaerobic power endurance and 'fade' over a series of intense intervals on an exercise bike. I would consider other tests if there were specific individual player issues, for example, a need to determine hamstring strength, due to a player's propensity to sustain strains. The average professional player's VO_2max is approx 60ml/kg/min (this indicates a high aerobic capacity on a par with a male elite 400m runner, but allows for a significant anaerobic contribution to their 'energy system power' – Ed). In terms of anaerobic power and the Wingate test, you are looking at player's power levels not declining by more than 15-20% between the first and tenth effort.

Field tests

These form the bulk of your tests. Keep them simple and specific. 'multi-stage bleep' or 'YoYo' tests can fall into this category. They are popular all around the world in many different sports. Top international manager Guus Hiddink wants his players to achieve level 14 on the bleep test. The average in the professional game is between 13.8 and 14.2. The 12-minute run is also a test I use – although there are numerous versions (different durations). At Ipswich, players achieve

distances of 3.35km/2.06 miles outdoors and 3.41km/2.1 miles on treadmills.

Game analysis

ProZone or Amisco analysis system (these computerised systems measure the speed and distances that players cover in a match).

Recovery test

There are numerous examples in use that have been designed on an individual basis by different clubs. Ours is simple and easy to do:

8 x 45 second multi-paced efforts on a pre-set circuit. The players' heart rates are monitored. The (active) recovery between the circuits is used to monitor their training status. Thus, if a player's heart rate is dropping and stabilising more quickly than it did during the active recovery in the previous tests, then their fitness has improved (active recovery involves gentle CV exercise, eg walking/slow jogging). We look for players not to fatigue by more than 8% in terms of heart rate recovery values, across the circuit.

Power – vertical jump test

Players' leg power can be measured using a force plate or the much more low-tech sergeant jump. Players use a countermovement jump – they bend and then extend their legs to jump. Professional players average approximately 57cm.

Speed – linear

There are many ways to test for speed. To be 100% accurate, speed gates with infra-red beams that time the start and finish and any intermediate points should be used. Players perform a flat-out sprint over 20m, with splits taken at 5m and 10m to assess acceleration. Static and rolling starts are used.

Speed – multi-directional

For example, the 'T agility sprint test' – where the player has to move forward, laterally and turn. (This is very similar to the test

the John Shepherd was put through by former England fitness coach Nigel Stockill – there is a great deal of transferability between sports, offering the opportunity to cross-learn).

Speed – endurance

There are numerous variations to this test. We might do 8 to 10 sprints over 30m or 40m, with a short recovery of 20-30 seconds. We are looking for professional players not to fatigue by more than 15% to 20% from effort 1 to effort 10.

Strength/local muscular endurance tests

Again there are many possibilities. These include using machines (isokinetic – that measure a muscle's constant force expression over a designated path) or everyday free weights or body weight exercises.

Selected scores from professionals:

Number of press-ups to failure – 65
Number of clap (plyo) press-ups to failure – 19
Squat (1 RM) – 1.5 times body weight.

A word of caution: any testing is only accurate if the players' attitude and effort toward it is 100%.

Make test conditions constant

Choose the right time to test. Avoid testing players when they are tired, or during a hectic schedule of games. Try to produce the same environment for each test as previously done, eg after a couple of days off, or always outside on a dry day (professional players are usually tested two to four times a year).

I believe that any test with a ball is testing skill. This makes it very much a coaching issue – therefore, in my opinion, you should avoid testing with a ball.

Over the years I would say that the manager and coaches' observations with reference to conditioning issues in games and training are right 75% of the time. The surprise and food for thought comes with the other 25% of the time! This is when test results could just make the manager and coaches think a bit, and perhaps rest or change playing and conditioning in regard to a specific player/players' needs.

Scott Pearson

Scott has been the conditioning coach at the one of the UK's top rugby sides, the Sale Sharks, for the last six seasons. He is part of a three man conditioning team that works closely with the rugby coaches and team's physios to ensure that the players reach matches in peak condition. **John Shepherd** *caught up with him in January 09*

John Shepherd: How many training sessions a day do the players do?
Scott Pearson: Usually about two, we tend to combine sessions, for example we might do a short weights session and then go straight onto the pitch to do some speed work, or the forwards will follow their strength work with live scrums.

JS: What's the rationale for that?
SP: We use scrums from a conditioning point of view, the players have to push bodies – that's a heavy weight. We pre-load them with the weights and fatigue them a little and then they go out and do the rest of their conditioning on the field.

JS: Do you do over speed workouts such as downhill running and elastic chord work (designed to increase a player's sprint speed)?
SP: No, we do uphill running and speed on the flat. I have done in the past, but not currently.

JS: Do you train agility?
SP: Yes and no, we contrast a lot of our speed work with the rugby side of it. Much of our speed work, we get from doing our back moves… So you have to use natural actual agility to hold a defender, to accelerate around him. We don't devise specific drills to do that. We try to keep it as open as we can.

(This is an important consideration for coaches – as Tudor Bompa indicated, gimmicks, although they might sound credible, may not actually be as effective at improving condition as specific training practice with you a coach pointing out how,

for example, a player can move to turn better and providing a prescription of relevant exercises.)

JS: Do you use undulating periodisation (a systematically planned training programme that mixes and matches training ingredients concurrently to maintain player condition)?
SP: Yes, we've got all these training boxes that we need to tick tactically and technically through the week and sometimes you need to be a little inventive about how you go about achieving these things.

JS: How important is pre-season?
SP: We do the majority of our work in the pre-season and then as the season goes on it's purely about keeping the guys fresh and ready to play at the weekends.

JS: How do you maintain player fitness in-season?
SP: It can be difficult, due the standard of play in the league and the cup, you can't really say there is an easy game where you can rest a few guys – and we don't really have a squad big enough to do that, so it's about keeping the guys fresh.

JS: How do you test and monitor the players?
SP: One thing we have done this season is to simplify our testing procedure. If you were looking at them (the tests) from a scientific point of view you could probably pick holes in them, but they are easy to do and we can do them in a training week. They allow us to get a handle on how the guys are doing. We do six tests: a 10m and 30m sprint, a couple of anaerobic endurance tests, an aerobic test and a strength test.

In the past I have done a whole battery of tests, but they take so long to do. You tend to do them on the first two days of pre-season and then don't do them again. So it makes them irrelevant because you are not changing any of your programmes accordingly.

JS: Do you train players differently according to their

positions?
We do to a degree, but the only positional group that trains really specifically are the front row, other than that we have quite a generic programme.

But you have great variation between the players, even within the same position. Oriol Ripol and Andy Tullagi are wingers, Oriol's 5'8' and 70kg and Andy 6'2' and 120kg so the training that they need is very different.

JS: So what kind of weight training do you advocate?
SP: We use barbells and dumbbells predominantly. It's generally a generic type of programme. We use exercises that all the squad can do. This allows us as coaches to be able to keep a handle on how they are doing and if they are slacking off a little… They do cleans, the bench press and squats, but we find that as the players get older, they pick up shoulder problems, which makes doing exercises such as the snatch difficult because they haven't got the range of movement.

JS: Are your weight training programmes designed to beef players up?
SP: Not really…what we are trying to overcome with players and coaches is the preconceived idea that you need to be big… for a lot of players we have actually reduced their weight, for example England back Mark Cueto, he's lost about 4-5kg from this time last year. And you can see how his injury problems have been reduced, his speed has gone up and he could return to the England squad for the Six Nations after last playing in the World Cup final. (*Cueto was actually named in the England squad – Ed*).

JS: What type of plyometric (jumping) training do you do?
SP: We do plyometrics every week as part of the leg session. Our leg work is aimed at developing strength and speed, so we do a lot of super-set work. The players will do heavy squats, then single leg squats, then squatting on BOSUs ('Both side up platforms' provide an unstable base on which the players exercise – Ed) and then into some kind of plyometric work and

then sprints. So 4-5 exercises back-to-back, developing strength through to speed.

JS: How difficult is it to fit in your work in with the rugby coaches?
SP: It's not difficult… generally in rugby strength and conditioning is quite well thought of and most coaches regard it highly …so most will let you do pretty much what you want, as long as the players are in shape to play at the weekends.

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