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ENGLAND ATHLETICS GUIDANCE

YOUTH ENDURANCE

ENGLAND ATHLETICS

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INTRODUCTION

This document is intended as an introduction for the youth endurance athlete, coaches, parents, teachers and significant others who play a role in their development. Its purpose is not to offer a definitive and exhaustive account of all things pertaining to youth endurance in track and field, but rather to give a concise overview of key areas and, more importantly, then to signpost to future development opportunities and learning.

The resource is divided into eight parts for ease of reading.

Part 1: From Participation to Performance – the Young Athlete's Entry into Endurance Running – looks at the key principle of late specialisation in the context of long-term athlete development.

Part 2: The Wellbeing of the Youth Endurance Athlete – encourages us all to see the young athlete as a whole person and explores issues around mental wellbeing in the context of underfuelling and overtraining.

Part 3: The Physiology of Youth Endurance Running – takes a look at energy systems and how they should be trained during adolescence, and what is appropriate Strength & Conditioning (S&C) work for the young endurance athlete to undertake.

Part 4: moves on to consider endurance running as skill acquisition, going on signpost appropriate drills for the young athlete.

Part 5: Strength & Conditioning – delves deeper in what sports science can offer in terms an understanding of how the running economy and efficiency of young athletes can be improved through a variety of modes of training, without risking injury.

Part 6: Road Running – recognises the growing trend for young athletes to want to work off track and offers guidance in this specific context, including both positive and negative case studies from former and, in some cases, current athletes from whom the young athlete of today can learn.

Part 7: Case Studies – offers an insight into the careers of past and present athletes, not so much in terms of what they achieved but, more importantly, how they approached their long-term athlete development.

Part 8: whilst cautioning against a prescriptive approach to generic schedule-based coaching of young endurance athletes, this section offers sample schedules which are a starting point to be individualised according to need.

Rather than being prescriptive, most chapters end with a number of self-reflection questions to help your development as athlete, coach or significant other, and signposts you to further development opportunities. To this end, this resource is the starting point of a journey rather than the destination, providing a 'Sat Nav' for you to get to where you want to be as safely as possible.

PART 1:

FROM PARTICIPATION TO PERFORMANCE – THE YOUNG ATHLETE'S ENTRY INTO ENDURANCE RUNNING

This section introduces the model of long-term athlete development which is a key philosophy underpinning the approach of England Athletics and should be at the heart of the development and progression of the young endurance athlete.

We begin by exploring the progression from fundamental and foundational development on to event group endurance running. The notion of 'athletic age' is broken down to explore the fact that chronological age (your actual age in years) is a relatively poor indicator of athletic ability compared to biological, training and developmental (emotional, cognitive and social) ages. The section moves on to explore debates about early versus late specialisation, as well as looking at junior parkrun as a facilitator of a pathway of entry into our sport, along with the use of suitably adapted competition. Junior parkrun sees an estimated twenty thousand 4 to14-year-olds participating in distance running events around the country every Sunday morning.

Long term athlete development

England Athletics encourages the philosophy of long-term development – often referred to as LTAD, rather than short term gain.

In terms of performance success, fulfilling long term potential is the key fous and not just immediate success at the expense of this long term goal. Critically, the athlete should perhaps not be labelled as a 'youth endurance runner' but rather treated as a 'sporty' person who should try to continue some kind of affiliation with a range of sports beyond track and field. (See Grace et al. 2014). This is a term typically referred to as 'sport sampling' or alternatively 'sport diversification'.

We know, for example, that multi-European champion javelin thrower Steve Backley started his career as a decent cross country runner. Post-retirement, he is nowadays a highly capable indoor rower. More recently, for the younger readers, Beijing Olympic 400m champion Christine Ohuruogu started life as a promising netball player. Any football fans amongst you may remember that London World Championship relay gold medallist Adam Gemili was once on Chelsea FC's books in his younger days. Hannah Cockroft began her sporting career in basketball, before progressing on to throws and ultimately wheelchair racing.

In previous decades, perhaps young athletes have been encouraged to specialise early in their teenage sport, being forced to effectively choose between a number of

things that they love equally and may be promising at. Additionally, any failure to make such a choice can often be wrongly seen by a parent, coach or even the young athlete themselves as evidence of a lack of 'commitment' or 'dedication' to track and field. As well as the ethical considerations that this outdated way of thinking raises, practically young athletes are missing out on developing what we call fundamental and foundational movement patterns.

Fundamental and Foundational Development

Many other sports apart from track and field athletics are cited by parents and significant others as putting considerable pressure on athletes to specialise at an early age. Some track and field coaches in our sport have reported that if their athletes don't specialise in say endurance running, they will almost inevitably be lost to another 'rival' sport. Kearney et al. (2021) found that 31% of parents and 8% of coaches wanted their athletes to specialise in track and field by 14 years of age. This may be the reality, and certainly it is a perception of reality which has unintended negative consequences if not managed ethically. This being said, before we as coaches point the finger at other sports we ought to make sure we are getting our own proverbial house in order. Blagrove at al: (2020: 2) point out that, "Young athletes should be exposed to a wide range of sports and physical activities during their adolescence; however, the priority should be placed on the development of rudimentary motor skills and muscular strength".

Due to the media-driven world which we now live in, brilliant benchmarking tools have emerged since the millennium, one of which is Power of 10. The benefits of such a benchmarking tool far outweigh the costs, but those costs have to be managed in terms of any unintended negative consequences, one of which may be the performative pressure which athletes feel by being constantly compared to one another. At a British Milers' Club Academy training weekend several years ago, for instance, star guest Jenny Meadows, who won a World Championship bronze medal over 800m back in 2009, told the audience that, had Power of 10 existed in her day, she would probably have quit the sport because of feelings of inferiority. The worrying thing about this story is that this was a former English Schools' champion speaking!

As coaches, parents and significant others in the sport we have a duty of care within athletics not to push and pull athletes into training groups which force them into single sport specialisation too early. The two golden rules are:

1. Encourage young athletes to do multi-sports for as long as possible and
2. When they specialise within athletics keep them running, jumping and throwing for as long as possible.

It is worth pointing out that, in their senior careers, athletes often retain elements of the training they did across sports beyond athletics when they were young. The 1983 World 1500m champion, Steve Cram, for instance, famously warmed up before training with his coach Jimmy Hedley by kicking a football about and doing 'keepie uppies'. Beyond track and field, possibly the greatest fighter of the last three decades, Roy Jones Jr, regularly used to warm up for his boxing matches by playing basketball in his dressing room before making his ring entrances.

Athletic ages

One of the biggest challenges which our sport has is our pre-occupation with chronological age. It's embedded in our sport right from junior athletic competition both at club and school and for those who once competed and remain as recreational runners. The old adage says that 'age is but a number' and that is most certainly true for chronological age. This being said, we should not throw the baby of chronological age out with the proverbial bathwater but rather we should retain and refine it.

The notion of biological age (see *Figure 1* below) is hugely variable during teenage years and has a massive impact on trainability. It is a better one than its chronological counterpart because for young athletes of the same chronological age some may be pre-pubescent and others post pubescent depending on rate of maturation. Health problems and injuries can affect the biological age of athletes too, and this becomes more marked over the years as athletes move from **junior to senior status**. Subsequently a minority are able to remain competitive as masters athletes because their biological age does not correlate with their chronological age – they are a 'Young 50 or 40' so to speak.

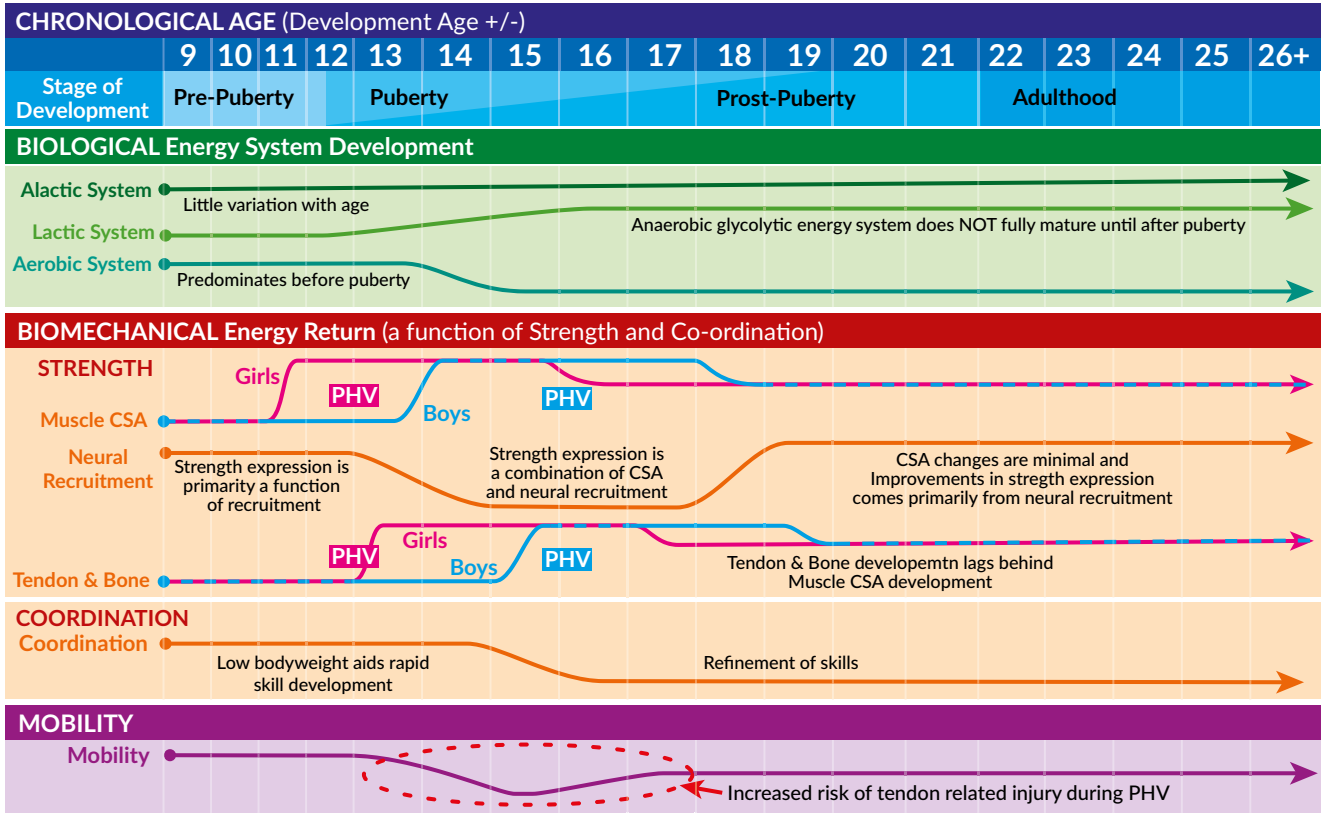


Figure 1. Biological Development, from the UKA Athlete Development Model (v.1.2)

Training and competition ages are hugely important for young athletes – it is not just how old they are or how mature they are biologically, it is also about how long they have been training and competing as endurance athletes. This is important for coaches in terms of remaining faithful to the principle of progressive overload.

The above are just the physiological components of 'age' and one cannot overlook the psychological composition of the notion. Developmental age infers that some young athletes will be more mature than others in emotional terms. PE teachers reading this will be aware that those born in the first three months of the academic school year (September-December), tend to be better equipped to deal with competitive sport in performative terms than those born in June or July for instance (see Kearney et al. 2018). This is known as the **'relative age defect'.** So, two young endurance athletes competing in the same 1500m race at the English Schools' Championships may be the same chronological age but materially different in terms of biological, training, competition, developmental and relative ages (see Long and French, 2015a). In addition, acquired injury as well as impairments need to be taken into consideration when planning training.

Event	Peak Performance Age – Men	Peak Performance Age – Women
100m	26	25
200m	25	25
1500m	27	29
5000m	29	30
Marathon	31	33

Figure 2. A Late Development Sport

The moral of the above is that athletes of the 'same age' are actually different and their diversity must be valued by coaches treating them in an athlete-centred way.

Questions for self-reflection

1. Why is chronological age a poor indicator of athletic ability?
2. What are the consequences of endurance running being a late specialisation sport?
3. How am I developing fundamental and foundational movement patterns which provide the basis for efficient athletic movement?

Resources for Further Development

If you are a visual learner consider the following:

Grace, S. (2020) *National Youth Development Webinar. What is Athletics 365 and how can it help my coaching?*

Grace, S. (2019) *National Youth Conference. Technical Developments in Young Athletes.*

Ritzdorf, W. (2019) *Keys to Youth Development*.

All these videos are available at:
www.athleticshub.co.uk/public/videofeed-all
Search using the video title.

If you learn by reading, for a greater elaboration of the principles of long term athlete development take a look at the following:

Grace, S., Harris, J., French, J. and Long, M. (2014) 'Handle with care' *Athletics Weekly.* 23rd January. pp.32-33.

Kearney, P., Hayes, P. & Nevill, A. (2018) 'Faster, higher, stronger, older: Relative age effects are most influential during the youngest age grade of track and field athletics in the United Kingdom', *Journal of Sports Sciences*, 36:20, 2282-2288, DOI: 10.1080/02640414.2018.1449093

Kearney, P. Thomas M. Comyns and Hayes, P. (2021) 'The Prevalence and Consequences of Within-Sport Specialization' in *Track and Field Athletics, Research Quarterly for Exercise and Sport*, 92:4, 779-786, DOI: 10.1080/02701367.2020.1776819

Long, M. (2015) 'Through The Ages'. *Athletics Weekly.* 16th April, pp.38-39.

Long, M. and French, J. (2015a) *One for the Ages*
Available from:
www.brianmac.co.uk/articles/article193.htm

Long, M. and French, J. (2015b) *Nurturing Talent*
Available from:
www.brianmac.co.uk/articles/article197.htm

PART 2:

THE WELLBEING OF THE YOUNG ENDURANCE ATHLETE

This section explores the lifestyle challenges faced by young endurance athletes in terms of balancing an education with their involvement in organised sporting activity.

Mental wellbeing is given centrality in understanding how the coach must develop the whole person and not just the athlete. Issues such as under-fuelling and overtraining are dealt with in the context of **Relative Energy Deficiency in Sport (RED-S)** and some of the most commonly documented injuries faced by young endurance based athletes. The section then proceeds to explore the role of psychology and motivational cues in the context of performance related sport.

Mental wellbeing

Promoting the value of good mental health and wellbeing through the coaching of the young endurance athlete is paramount. This can be achieved through the **CARE** acronym:

C oaching and Customer Skills

This involves being welcoming; talking about mental health; offering alternatives and taking feedback from the athlete.

A wareness

The coach should ask the young endurance athlete how they feel; pay attention; use observation and listening skills and ask how they would like to be supported.

R espect

Avoiding the asking of intrusive questions and ensure you treat everyone fairly, making yourself available to hear about problems whilst treating what is heard in confidence are all things which good coaches should do with athletes, regardless of event type.

E mpathy

Coaches have a moral and practical responsibility to learn from reliable sources; to listen, seek and understand without feeling pressured to find answers and always seeing the individual in front of them rather than just a mental health diagnosis.

Case Study: Jack Green

London and Rio Olympic 400m hurdler Jack Green has bravely gone public in terms of acknowledging his battles with mental health, which include anxiety and depression. After experiencing feelings that he has underachieved at a home Olympics in 2012, the man once voted by *The Times* newspaper as the most talented young athlete of a generation found himself in Birmingham's Priory clinic for several weeks after being deemed at risk of self-harm. A combination of anxiety, anti-depressants and performance

pressure saw him embark on three spectacular DNF races at the Loughborough International, Doha Diamond League and European Juniors in 2013. Green has openly admitted that he would regularly vomit multiple times prior to races (see Green, 2021).

In recent years, England Athletics has facilitated the growth and development of Mental Health Champions and these people are on hand to signpost to coaches and significant others where support can be accessed. Over time, counselling helped Green realise that his motivators had become almost exclusively extrinsic rather than intrinsic and he has said, "My whole career had become solely about just achieving a result". It took him months if not years, with the support of counselling, to challenge his unhealthy thought processes and to accept that, "if you measure yourself on perceived effort rather than just a result you will end up becoming a better athlete for it". In a pertinent message to all young athletes, and not just those who are endurance focused, Jack has said that, "We need to work on encouraging each other to show our vulnerabilities because if we don't we live in a culture of fear which will always inevitably hold us back".

Jack is now giving back to the sport of athletics along with many other professions in this area as the Head of Performance for Champion Health.
www.championhealth.co.uk

Sources of support

Some of the avenues of support available are as follows:

- **Mind**
  Telephone: 0300 123 3393
  Email: info@mind.org.uk
  Website: www.mind.org.uk
- **Samaritans**
  Telephone: 116 123 (24 hours a day, free to call)
  Email: jo@samaritans.org
  Website: www.samaritans.org
- **Rethink Mental Illness advice line**
  Telephone: 0300 5000 927 (9.30am – 4pm, Mon –Fri)
  Email: info@rethink.org
  Website: www.rethink.org
- **Saneline**
  Telephone: 0300 304 7000 (4:30pm-10:30pm)
  Website: www.sane.org.uk
- **The Mix**
  Telephone: 0808 808 4994 (11am-11pm, free to call)
  Website: www.themix.org.uk
- **ChildLine**
  Telephone: 0800 1111
  Website: www.childline.org.uk
- **Side by Side**
  Website: https://sidebyside.mind.org.uk

Relative Energy Deficiency in Sport (RED-S)

We now move on to discuss an issue which is physiological in its manifestation but may be psychological in terms of its causation.

RED-S is a condition of energy deficiency which causes negative adverse effects on all systems in a body. Traditionally it was wrongly assumed to be something almost uniquely associated with female athletes but it is fortunately now accepted that It affects both male and female athletes who do not fuel adequately, either intentionally or unwittingly. The term has somewhat superseded the more gendered notion of the female athlete triad: this involves the continuum of three factors – disordered eating, amenorrhea (the absence of the menstrual cycle) and osteoporosis (reduced bone density and quality). This being said, for female athletes not starting periods by age 16 or not having periods for more than 6 months should seek medical advice. If this issue is not identified and addressed it may lead not only to adverse impact on performance but, more importantly their health and wellbeing. Significantly the prevalence of disordered eating is 20% higher amongst athletes compared to non-athletes and is associated with those who have perfectionist tendencies as well as the performative pressure alluded to in Part 1 of this document.

Back in 2018, a panel of former elite athletes were vocal about the issue and some of whom held positions where they were actively researching disordered eating. The warning signs of disordered eating may include sudden changes in weight, changes to eating habits such as cutting out major food groups, and avoiding eating with others. This can potentially lead to excessive fatigue, frequent niggles and illnesses, plus the emergence of compulsive exercise habits.

Those deemed at 'high risk' of falling into this trap tend to be undergoing puberty and may be suffering excessive levels of performance anxiety. Often they tend to have a psychological disposition which leads them to be overly rigid and 'fixed' when it comes to exercise routine. A member of the former elite athlete panel has disclosed: "I was terrified of puberty! It needs to be appreciated that having a menstrual cycle is a normal, natural process that symbolises being healthy. It isn't just about blood loss, it is all about the change in hormones." The issues are compounded by the fact that an athlete with RED-S may continue to perform relatively well for a short period of time and to all intents and purposes appear to the uneducated eye to be healthy, despite the hidden process of overtraining (too much overload in

too short space of time) and underfuelling. Quantitative metrics such as fluctuations in body weight may give an indication that RED-S could be an issue, but again it is worth noting that an athlete's Body Mass Index (BMI) may be "normal" despite under-fuelling and despite them placing themselves at risk of poor long-term outcomes. A English Schools' Champion has, for example, said that "It is important to get across that the unhealthy habits and image don't always come across as extreme (I wasn't one of those skeletal athletes) yet they were having a damaging impact."

The support group around the athlete may perceive there to be a potential problem but that may not absolve them of the difficulty of convincing athletes of the long-term risks associated with their dietary and training practices. Another former Elite Endurance athlete has warned "Be prepared for denial. The athlete may not yet recognise that they have a problem, but knowing that someone is concerned can be enough to get them thinking about it. Do keep communicating and reiterating your concerns." (see Dudgeon and Long, 2018).

If an athlete and/or coach identify with symptoms of RED-S then medical intervention rather than self-diagnosis is the safest way forward. General Practitioners (GP) may not themselves have a monopoly of knowledge on this subject, but can and will refer on to support services.

Case Study: Bobby Clay

Former European Junior 1500m champion Bobby Clay is someone who has been remarkably brave and candid in articulating how RED-S effectively destroyed her promising career (see Cluley and Clarke, 2021). She is someone who was caught in the dangerous cycle of overtraining and underfuelling. With regards to the former she has said, "Like all athletes, I am obsessive. I am obsessed by athletics, with training and with being the best. Looking back now, no amount of training would have ever been enough to satisfy my hunger to do more." Whilst at University, A DEXA scan (a dual energy X-ray absorptiometry scan measuring bone mineral density) revealed Bobby had osteoporosis (see Clay, 2017).

Self-reflection questions for athletes

1. As a female athlete in what ways am I aware of the health benefits of a regular menstrual cycle and the need to seek medical advice if I have not had a period by the age of 16?
2. How do I reflect on my training schedule in terms of frequency, intensity and duration of work to make sure I am avoiding the effects of over-training?
3. In what ways does my training diary record other indicators which may suggest RED-S may be a factor in terms of weight, lack of ability to recover between sessions, poor concentration and depression?
4. To what extent am I prepared to commit to long term development and progression in the sport? To what extent am I aware that pursuing short-term success can put my long-term development at risk?

Questions for coaches, parents and support groups

1. In accepting that I want the female athlete to be open and honest about menstrual health, how comfortable am I in talking about this appropriately?
2. In what ways does my communication with the female athlete reinforce the positive health benefits of a menstrual cycle?
3. As a coach, how do I ensure variation in schedules to avoid the effects of over-training. For example, drill/ circuits/cross training sessions?
4. What mechanisms are available to me to spot signs of RED-S in terms of illness, injury, excessive fatigue and poor mental health of the athlete?
5. As a coach how am I remaining faithful to the principle of 'athlete-centredness' by building towards long-term goals rather than short-term success?

Performance Psychology

Having considered mental health and wellbeing, we now move on to consider the more performance-related aspect of sports psychology.

Traditionally, when talking about the psychology of young endurance athletes, some of the dominant ways of thinking have perhaps unhelpfully labelled people as having certain personality traits, such as 'nervous', 'confident', 'introverted' or 'extroverted'. These terms may be unhelpful because if we accept that young athletes are born and then socialised into having certainly fixed personality traits it rather serves to disempower the coach and significant others from feeling that they can do very much to alter the thought process of the young person before or even during a competition.

It may be healthier for young endurance athletes, coaches and significant others to think about the fact that rather than being bound by immovable personality traits they can in fact be shifted and in turn help to shift themselves between various different states of mind. On such state-based theory which may be of use as an intellectual resource is Reversal Theory.

Reversal Theory was initially proposed almost four decades ago by the psychologist Dr Michael Apter and consultant child psychiatrist Dr Kenneth Smith. In 1975, this pairing developed a model of human motivation that articulated two primary and opposite motivational states. The underlying philosophy of this theory rejected conventional psychological wisdom by espousing that individuals are not rigidly fixed in terms of definitive personality 'traits' but instead they may have two fundamental 'states' of mind which can be alternated when triggered.

In its simplest terms, 'telic' is indicative of goal-focused motivation and behaviour, whereas 'paretelic' is a process focussed motivation and behaviour. For example, the telic state of a javelin thrower may be to exceed 70 metres. This will have been pre-planned and agreed with the coach and will fit into a wider training plan. The paratelic behaviour of the same javelin thrower may kick in when, during a competition, this goal fades into the background. They may be feeling the grip of the javelin in their right palm as their number is called to throw or experiencing the rush of adrenaline as a Diamond League crowd begins to clap rhythmically. The goal has been momentarily forgotten, and the 'here-and-now' is everything. In describing how a shift between polar states can be affected, internationally respected coach educator Peter Thompson (2006) has offered the analogy of a light switch, "Just as the switch on the wall can be either 'on' or 'off', the two stable positions in all of us are opposites" and can be reversed.

Case study: David Hemery

The following account is taken from *Long and Lowes* (2012):

1st October 15, 1968. Olympic 400m hurdles final. Mexico City.

In the pre-competition mode, Hemery reflects that he was in a 'telic' state of mind with a clear goal focus, "Before the start, the aim was to deliver a world record paced run, and I hoped that would be good enough to win. My goal focus was to avoid losing." This is significant in that his doctoral research (published as 'Sporting Excellence' in 1991) involved interviewing 83 elite athletes across 22 sports and 12 nationalities, including the likes of legendary golfer Nick Faldo and tennis player Stefan Edberg. While 60% of interviewees were aiming to win, the other 40% saw themselves as winners who wanted to avoid losing.

David's self-categorisation into the last 40% suggests that retention of his self-image was one of avoiding the label of 'loser'.

In his autobiography, *Another Hurdle* (1976) he recalls that in the medical room, "I was practically paralytic with fear." Interestingly, he remembers that both he and eventual bronze medallist John Sherwood, "were able to crack bad jokes in our attempt to relieve the tension." Thompson (2006) articulates how the use of humour is a key trigger in shifting athletes from high arousal telic states of anxiety towards the high arousal paratelic state of excitement. With 50 minutes to go before the race, Hemery's book recounts a conscious attempt to move away from the goal-focussed telic state towards the paratelic while at the

warm-up track, “I took off my shoes and jogged around the grass. The dampness under my feet took me back 12 months to the time when I had been running on the edge of the water along the firm sand (of a beach in the USA). I tried to recapture some of the joyful and enthusiastic thoughts and feelings I had experienced.”

The man who would eventually hang up his spikes with a complete set of Olympic medals continues, “The delivery was in a controlled state of fear! The more nervous I was about a race, the faster I ran. I did attempt to take controlled self-management of that state – in the waiting room 20 minutes before the race, reducing my heart rate through slow breathing, focusing on what I could control.” According to Hanin (1997) to perform their ‘optimum arousal’ level, the anxiety of an athlete has to fall within their ‘optimum functioning zone.’ Additionally, Hardy and Frazer’s *Catastrophe Theory* (1987) articulates how each athlete will respond differently to competitive anxiety. In contrast to both Catastrophe Theory and optimal arousal theory, Reversal theory allows us to see how Hemery’s ‘understandable’ nerves could be turned into a state of very high arousal and excitement of the kind productive for world-class performance.

The Olympic champion’s use of controlled breathing is indicative of the five breath technique articulated by Karageorghis (2007). It is most likely that he was a ‘paratelic dominant’ athlete who was most responsive when the challenges presented the highest level of arousal. He added, “I avoided looking at the opposition or getting drawn into their nervous jogging in that very small space.” This ability not to get sucked into displacement activities which may be detrimental to optimum performance is indicative of the kind of ‘emotional control’ described by Brian Mackenzie (1997) which is maintained despite considerable distractions.

Hemery’s account of the 48.12 seconds between the gun and Olympic immortality is one of constant switching between the aforementioned telic and paratelic states. He launched out in the latter state as he recalls, “The primary focus was internal pace judgement and stride pattern/stride length focus.” BBC’s animated and emotional broadcaster David Coleman is shouting into his microphone, “Hemery is gambling on everything, he is flying down the back straight.” A reversal back to the telic goal-focused state seems to have occurred in those early stages as Hemery recalls, “I passed one of the pre-race favourites, Ron Whitney before hurdle three who was one lane outside of me in lane seven. I thought he had gone off slowly but would probably then be tagging onto my shoulder as I went by.” This momentary shift was quickly reverted to the paratelic state with Hemery saying, “I refocused on maintaining my speed and strides through to hurdle six.” This was necessary to make a necessary technical adjustment to alter the stride pattern from 13 to 15, “which is when I needed to take 12 inches (30cm) off each stride, following a normal take-off and landing. It also meant accelerating the cadence to avoid losing too much momentum,” he added. His book recounts how “I felt as if I were running in slow motion as I saw every inch of where I had to place my feet. I was vividly conscious of myself, the red tartan surface, and the hurdles on that final bend.” A reversal towards the telic occurred while he was, “briefly conscious of passing John Sherwood who was out in lane eight, but that was more as a pace judgement marker.”

Late into the race, Hemery experienced a reversal towards the paratelic, due to the rainy conditions which had occurred between 4 pm and 6 pm on the day of the final. He recalls, “After hurdle seven I was again distracted externally when I heard a foot splash in a puddle, which sounded as if it were only a few feet behind me, to my left.” The triggering of this paratelic experience by an environmental cue appears to have instantaneously triggered a reversal back to the telic state as he vividly remembers, “My intent was to win, so it was a blessing as it sent a shock and a shot of adrenalin through me that I hadn’t got away from the rest of the field.” Once again, anxiety appears to have been an appropriate motivator of the man who would go on to be remembered as one of Britain’s best ‘Superstars’ between 1973 and 1977, with the telic state coming to the fore. He continues that, “I did have a potentially negative thought coming into that eighth hurdle, that I wasn’t sure that I could hold the pace and a calm, rational thought came back, ‘you have to, this is the Olympic final!’ “

Even as the tape loomed, one last reversal from telic to paratelic seems to have occurred with the looming Olympic gold being momentarily forgotten in favour of more process motivating thoughts. “As I stepped over the final barrier, on landing I remembered that Billy Smith, my US coach, had written to say, ‘go at the last hurdle as if it’s the first in a high hurdles race.’ The fact that I had forgotten made me try to change into a sprint, which I didn’t feel was a sprint. It was as fast a stride as I could muster to the line.”

Coleman was screaming into his microphone, “Hemery won that from start to finish. He killed the rest, he paralysed them!” Over four decades later, a modest Hemery, Vice Chairman of the British Olympic Association jokes that “I only looked good because the others faded!” He crossed the line almost a second ahead of West German silver medallist, Gerhard Hennige and stopped the clock in a world record which catapulted him to the crown of 1968 BBC Sports Personality of the Year.

This case study leaves us with a number of pertinent questions for both athlete and coach:

Athlete questions for self-reflection

1. What are my coping strategies for avoiding becoming overly nervous to the point where my performance may be negatively affected?
2. How do I best focus in the hours and minutes before my event(s)?
3. What, why and when do I need to think about certain triggers during my event(s)?

Coaching questions for self-reflection

1. How should I behave when a young athlete I coach is about to compete and what signals am I sending out to him or her?
2. What triggers the athletes I coach into a positive state of mind to make them race ready?

Resources for Further Development

If you are a visual learner go for:

Altwasser, C. (2020) *Psychology*.

Douglas, N. (2020) *Mental Strength and Resilience*.

Green, J. (2021) *Managing elite performance and mental health.*

Keay, N. (2020) *Endurance. REDS, Introduction. A*

All these videos are available at:
www.athleticshub.co.uk/public/videofeed-all
Search using the video title.

If you learn by reading get to:

Clay (2017) 'My Osteoporosis nightmare'. *Athletics Weekly*. November 26th. Available at: https://athleticsweekly.com/performance/bobby-clay-my-osteoporosis-nightmare-70422/

Cluley, E. and Clarke, J. (2021) 'Bobby Clay: British athlete on body acceptance after RED-s caused osteoporosis'. Available at: www.bbc.co.uk/sport/athletics/56353786

Dudgeon, E. and Long, M. (2018) 'Treading A Thin Line'. *Athletics Weekly*, January 4th. pp.36-37

Long, M. and Lowes, D. (2012) Mental Hurdles. A*thletics Weekly*, June 7th, 2012, pp.34-35 or Long, M. and Lowes, D. (2012) *Goal & Process Motivation* Available from: www.brianmac.co.uk/articles/article133.htm

PART 3:

THE PHYSIOLOGY OF YOUTH ENDURANCE RUNNING

This section explores the interplay between the three energy systems and especially how the coach needs to adapt training and their approach to competition based on the fact that the pre-pubescent endurance athlete will have a relatively under-developed lactate energy system.

Information on energy systems is contextualised by reference to growth patterns and pubescent changes amongst adolescent athletes, which impact on frequency, intensity and volume of training as well as the significance of mixed mechanical loading. Modes of endurance-namely aerobic, strength and speed are then explored in more detail. The energy systems are then linked to debates about models of periodisation in terms of their applicability to the young endurance athlete.

Building a solid future

There are some key physiological differences between pre-pubescent children and young adults which must be considered. A child's maximal heart rate, for instance, may be as much as 215 beats per minute, which compensates for the smaller heart.

Former National Coach Mentor for Youth Endurance, Charlotte Fisher, has spoken about the need for coaches to build (1) Robustness, (2) Longevity, (3) Balance, (4) Symmetry and (5) Order in the way in which young endurance athletes are trained. In addition, children have a much higher respiratory rate than adults and this leads to a much more rapid loss of water from the lungs.

It is worth remembering that children's physiological development can be characterised as being relatively 'stop-start' in the following ways:

- **3-6 Years** (pre-school) -
  Rapid physical growth and brain development.
- **6-12 Years** (school aged) -
  Slow physical growth and steady brain development.
- **12-17 Years** (adolescence and puberty) -
  Rapid physical growth. Initially rapid and then steady brain development.
- **17+** (early adulthood) -
  Slow physical growth and steady brain development

The energy systems

We have three energy systems which, critically, are interdependent and not mutually exclusive. The one which we use most of the time as human beings is the aerobic energy system. 'Aerobic' basically means 'with oxygen' (see Long, 2012). Aerobic energy production is switched on much more quickly in young growing athletes than in their mature counterparts. This system also switches off much more quickly and allows restoration

of Phosphocreatine (PCr) and clearance of lactate, thus making repeated bouts of short sprinting much easier. The young endurance athlete needs to have a well developed aerobic energy system because endurance events require this energy system to a lesser or greater degree as the distances increase. The aerobic energy system can be developed in many different ways and not just steady state running. Activites such as cycling, swimming or even team sports can also help the development of the aerobic system. Steady state running is indeed important but, as discussed in Part 1 of this document, a commitment to a multi-sports ethos can help develop this energy system so as to avoid placing unnecessary stress on the joints and tendons. Swimming and cycling, are, for instance, great examples of ways in which aerobic development can be achieved whilst minimising unhealthy mechanical loading.

Aerobic development begs the question of maximum distances for young athletes and this includes both training and competition. The former can be developed through a multi-sports ethos whereas the latter is related to competition.

Figure 3. Maximum recommended running volume of training

Training Year After Puberty	Age	Weekly Total Distance Winter –	Long Run (once a week)
7	18	25-80 km (15-50 miles)	60 mins
6	17	20-70 km (12-43 miles)	55 mins
5	16	20-60 km (12-37 miles)	50 mins
5	15	15-50 km (10-30 miles)	45 mins
3	14	15-40 km (10-25 miles)	40 mins
2	13	10-30 km (6-20 miles)	35 mins
1	12	10-25 km (6-15 miles)	25-30 mins

As well as the above, in terms of mechanical loading, it is important to consider the type of surface the young endurance athlete is working on.

Figure 4. Maximum recommended running volume by mode of surface

ROAD RUNNING *(Maximum Racing Distance)*	
Age on day of competition	**Maximum Distance**
Over 11 - Under 13	5,000m
Over 13 - Under 15	6,000m
15 years	10,000m
16 years	15,000m
17 years	25,000m
Over 18 - Under 20	Marathon

CROSS COUNTRY *(Maximum Racing Distance)*	
Age Group	**Maximum Distance**
Under 13	3.500m
Under 15	5,000m
Under 17	6,500m
Under 20	10,000m

FELL & HILL *(Maximum Racing Distance)*	
Age Group	**Maximum Distance**
Under 12	3.000m
Under 14	5,000m
Under 16	7,000m
Under 18	10,000m

TRAIL *(Maximum Racing Distance)*	
Age Group	**Maximum Distance**
Under 12	3.000m
Under 14	5,000m
Under 16	6,000m
Under 17	10,000m
Under 18	25,000m
Under 20	45,000m

The charts provided in this resource should be used as guidelines and be adapted as necessary to ensure they are appropriate for each individual athlete (based on their age and stage of development).

This leads to the following recommendations for cross country running (see *Figure 5)*, which is a prerequisite for the youth endurance runner in being able to build both aerobic and strength endurance, as well as working on the agility, balance and co-ordination in terms of the fundamental and foundational movement patterns which are engendered by slipping, sliding, twisting and turning over the cross country course..

The second energy system which is needed by the young endurance athlete is the alactic energy system. This energy system is sometimes referred to as the ATP-CP system. This is the 'quick-start' energy system which can be used for up to 10s without oxygen being needed or waste products being produced in the system. This energy system is useful for the young endurance athlete when sprinting off from the start to gain a good position; after breaking after the first bend in the 800m; it's vital on the other hand when effecting a sprint finish over the last 60m of a 1500m race or in putting in a mid race surge to overtake athletes in the 3000m. The ability to preserve this system is dependent on having a well developed aerobic system which effectively means that the alactic system can be 'spared' for this final phase. The system is also brought into play when athletes use short strides as 'primers' before the start of a race to add the 'P' of 'Potentiation' at the end of the RAMP warm up (Raise, Activate, Mobilise, Potentiate).

The final energy system which is needed by the young endurance athlete is the lactate system, commonly referred to as the anaerobic energy system. This is perhaps the most problematic energy system to talk about for the young endurance athlete because the lactate energy system tends to be underdeveloped in young people prior to puberty. So two 13 year old males may have fundamentally different lactate energy system capacities simply because one has gone through puberty and the other has yet to complete this journey. The child's muscle contains much less creatine phosphate and less glycogen and consumes glycogen more slowly than an adult's muscle. The child accumulates less 'oxygen debt' and recovers from a short effort more quickly, and children produce less acid than mature athletes when carrying out anaerobic activity. The table below (*Figure 6*) shows the relative energy contribution of each respective athletic event for an adult athlete. For younger athletes taking longer times to complete the distances, there will inevitably be a greater aerobic contribution at work, but the following gives us an idea as to what the longer term development of the youth endurance athlete should be aiming for.

Figure 5. Recommended Maximum Distance for Cross Country Competitions

School Year	Age	Age Group	Recommended Max Distance	Distance Increments
Year 3	7-8	-	1.200m	-
Year 4	8-9	-	1.600m	+400m
Year 5	9-10	-	2,000m	+400m
Year 6	10-11	-	2,500m	+500m
Year 7	11-12	Under 13s	3.500m	+1,000m (over 2 years)
Year 8	12-13	Under 13s	3,500m	+1,000m (over 2 years)
Year 9	13-14	Under 15s	5,000m	+1,500m (over 2 years)
Year 10	14-15	Under 15s	5,000m	+1,500m (over 2 years)
Year 11	15-16	Under 17s	6,500m	+1,500m (over 2 years)
Year 12	16-17	Under 17s	6,500m	+1,500m (over 2 years)
Year 12	16-17	Under 18s	10.000m	+3,500m (over 2-3 years)
Year 13	17-18	Under 18s	10.000m	+3,500m (over 2-3 years)
University	18-19	Under 20s	10.000m	+3,500m (over 2-3 years)

Figure 6. Energy system contribution by distance

Distance	ATP-PC Max HR	Anaerobic-Lactate 90% Max HR	Aerobic-50- 85% Max HR
800m	10%	30%	60%
1,500m	8%	20%	72%
3,000m	5%	15%	80%
5,000m	4%	10%	86%

The lactate system is associated with endurance events such as 800m and 1500m which tend to take between two to four and somethingor soheir intensity, waste products in the form of lactic acid is produced along with the lactate which is actually a productive fuel which moves energy around the body. Children take much longer to cover these middle distances compared to adults and this means that the aerobic energy system is also a key determinant of performance in these events. What is commonly referred to as 'lactic acid' is the feeling which one gets of wanting to be sick in the stomach or feeling heavy legged. Researchers from the Children's Health and Exercise Research Centre, based at the University of Exeter, have stated that maturity plays a significant role in the development of aerobic and anaerobic energy systems.

Figure 7: Variables associated with energy system development

	Anaerobic Alactic ATP-PC	Anaerobic Lactic	Aerobic-
Duration	0-8 sec	8 sec - 1 min	1-60 mins+
Distance	20-30m	280-400m	300m-15km /continuous
Intensity	Maximal	90-100%	50-85%
Repetitions	3-4	1-5	1-20
Recovery	1-3 mins	2-10 mins	1-3 mins
Sets	1-4	1-4	1-4
Recovery	8-10 mins	10-20 mins	5-8 mins

So in contextualising the above, what it means in practical terms is that the young endurance athlete cannot be trained in the same way as the adult. Whereas an adult endurance athlete may be able to do 10 x 400m in a repetition, it is naive and potentially inappropriate to think that a young endurance athlete could do say 6 x 400m. The lactate energy system has to be trained carefully in the young endurance athlete. One of the ways which this can be achieved is through the use of the unstructured fartlek, which translates as 'speed-play', in which athletes speed up and slow down when the wish This is ideal to work each and every energy system in the young athlete appropriately as they run, jog, walk and skip through the session. In Peter Thompson's *The Physical Components of Fitness*, for athletes in the Foundation Stage the duration of the fartlek could be 5 - 15 minutes, while in the Event Group Development Stage it would usually be something between 10' - 20' duration. So at the onset of the growth spurt in adolescence aerobic training should take the form of longer and slower distance and fartlek (speed-play) type training. When growth slows the emphasis can then be placed on more intensive modes of interval training. The golden rule is that high volume strategies are deemed inappropriate until post-puberty.

Energy systems can be monitored through a zonal approach using the Talk Test, where athletes should be able to talk normally whilst running. To contextualise the zonal system there are three key physiological variables which need to be operationalised – namely Lactate Threshold (LT), lactate Turn Point (LTP) and Maximal Oxygen Uptake (VO2max).

Lactate Threshold represents the first increase in blood above baseline values. The speed and heart rate at the Lactate Threshold are also useful in defining the transition between 'easy' running used for recovery and 'steady' running which is used for aerobic base building.

Lactate Turn Point is the running speed at which there is a definitive 'sudden and sustained' breakpoint in blood lactate. It tends to occur at about 1-2 km/h above the LT and is useful in defining the transition between so called 'steady' and 'tempo' running.

VO2max (the highest rate at which ATP can be re-synthesised aerobically) and may be highest in athletes who specialise in events that are run close to VO2max, such as 3000m for young endurance athletes.

Coaches working with youth endurance athletes should ensure that they plan sessions which cover all the different training zones at the appropriate points of the periodisation cycle.

The following model was producedby several years ago by the late Dave Sunderland, Jenny Harris, Dave Rowland and Dr Barry Fudge, and serves as a good broad reference model for the complete spectrum of training modalities.

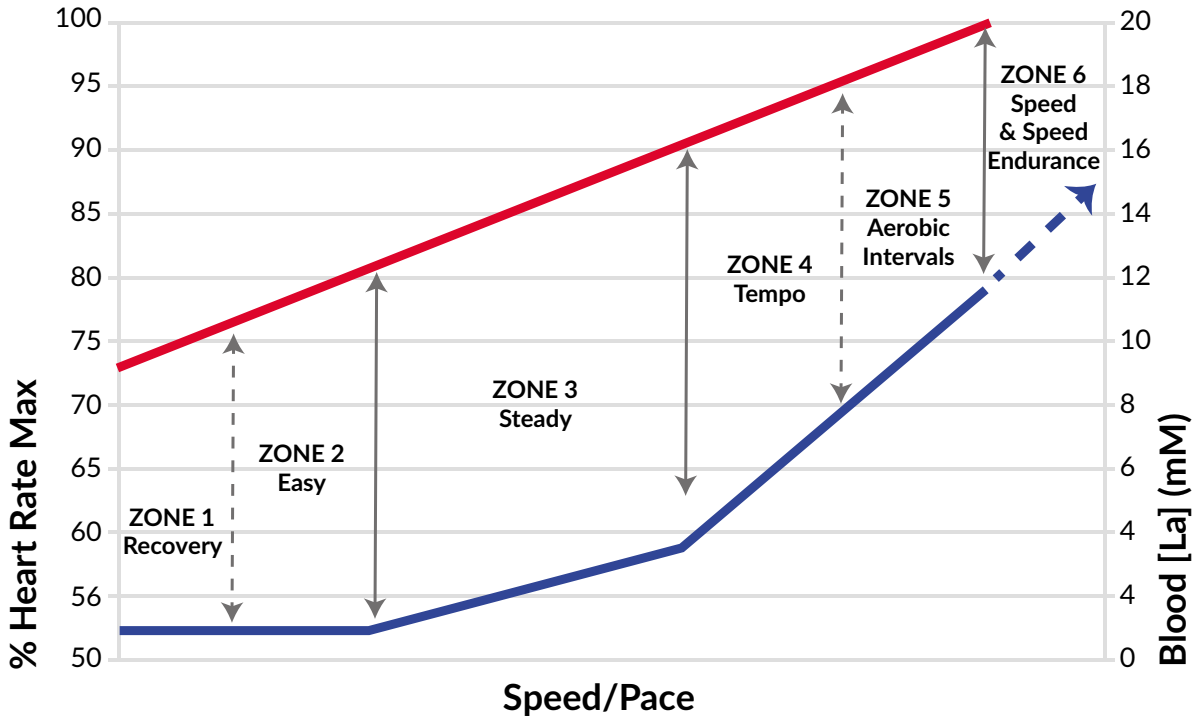
It should be noted, that as any athlete gets fitter, their heart will change and how they work within the relevant Zones will also change. It is key that coaches and athletes individualise the training Zones to their own heart.

In the early stages of development, Zones 1 & 2 can be being similar and can Zones 5 & 6. As the athlete progresses further through the pathway and becomes better conditioned, specific use of all the training zones become more appropriate.

Figure 8: Training Zones

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Description	Recovery	Easy	Steady	Tempo / Extensive Aerobic Intervals (threshold)	Intensive Aerobic Intervals (VO2)	Speed Endurance (Anaerobic Speed) (Reps)
Approximate Pace	-	-	-	10km	3-5km	1,500m or faster
Perceived Exertion	Very easy	Easy	Comfortable	Uncomfortable	Very stressful	Maximal
Breathing Reference	Very easy to talk	Easy to talk	OK to talk	Hard to talk	Cannot talk	N/A
Typical % HR Max	<60%	<80%	81-89%	90-95%	96%-Max	Max
Typical [La] range (mM)	-	<2	1.0-4.0	4.0-9.0	9.0-12.0	12.0-22.0

Figure 9: Training Zone Distribution



Zone 1 Recovery Runs are used to help regenerate the system both after hard training sessions and races and must be aerobically based sessions where the athlete could comfortably hold conversation. They are a continuous rather than discontinuous mode of session.

Zone 2 Easy Running is more commonly associated with the long run as a key way in which to improve aerobic capacity and is once again effected continuously as is the recovery run.

Steady Running in Zone 3 is that which is effected above Lactate Threshold but below Lactate Turn Point (e.g. 81-89 % of max heart rate). At the lower end of the zone (81-85% of max heart rate), the athlete leans towards medium to long workouts and at the higher end of the zone (86-89% of max heart rate), the athlete will tend towards medium to short workouts.

Tempo Pace Zone 4 is in physiological terms the running pace at or just above that where the blood lactate system begins to spike in terms of Lactate Turn point. Tempo runs tend to be constant pace efforts which are performed over a relatively prolonged period of time or they can be blocked into separate chunks with float recoveries – which is a practice known as 'in and out' tempos. Wheelchair athletes may be able to effect 'roll' recoveries, meaning they can cover more distance for the same effort as an ambulant athlete. This latter practice can lead to Aerobic Intervals (sometimes referred to as cruise intervals and/or threshold runs). These multiple reps may be effected in sets, are run at the upper end of the zone, and tend

to need a longer and more passive mode of recovery in between. This type of training stimulates improved economy and increased fatigue resistance, allowing the body to gradually increase the work it can do without accumulating progressive amounts of lactate.

Zone 5 Aerobic Intervals work is indicative of Intensive Aerobic Intervals and in physiological terms there will be an accumulation of blood lactate, often between 5-12 millimoles by the end of the session, with the primary goal being to maximally challenge the aerobic as opposed to the anaerobic system. To do this, the distance or time governing each rep usually needs to be a minimum of 3 minutes as it takes around 2 minutes to reach the point where the body is operating at VO2max – the purpose of the workout (see French and Long, 2012). If performing shorter duration reps (e.g. 1 minute reps) then recovery must be reduced so that the athlete is not fully recovered before the start of the next rep. The athlete should aim for equal to (if taking active recovery), or a little less than (if taking complete rest – generally half the rep duration) the rep duration. Sessions which for mature athletes would be deemed as speed endurance sessions (anaerobic), will tend to be more aerobically based for younger athletes due to their metabolism.

Zone 6 involves anaerobic **speed or speed endurance** and heavily utilises the lactate energy system. It typically involves operating over a number of short repetitions with sufficient passive recovery time to allow each subsequent run to be just as efficient as the first repetition of the session.

In terms of disability athletics, impairment specific considerations – such as fatigue for athletes with CP or fatigue for athletes running using a prosthesis – need to be factored in to physiological considerations concerning energy systems.

In terms of monitoring work and the effects of working across a range of training volumes and intensities, the work of Mann et al. (2018) is pivotal in understanding how scales of perceived exertion are great for young endurance athletes and their coaches to be able to monitor internal training loads rather than purely relying on physiological data such as heart rates and blood lactate levels.

Questions for self-reflection

1. How am I managing the loading of my running in terms of frequency, intensity and time on feet?
2. When and how should I develop the respective aerobic, lactate and alactic energy systems?
3. Which other sports and activities am I undertaking which also develop the three energy systems?

Resources for Further Development

If visuals are how you learn best then watch:

Leonard, M. (2020) *Working the Energy Systems - How much of each?* Available at: www.athleticshub.co.uk/public/videofeed-all

For those avid readers amongst you reach out for:

French, J and Long, M. (2012) *Developing Aerobic Capacity* Available from: www.brianmac.co.uk/articles/article132.htm

Long, M. (2012) 'Its good to talk', *Athletics Weekly*, 15th November, p. 39

Long, M. and Lowes, D. (2014a) 'Country Matters', *Athletics Weekly*. September 25th, pp.58-59.

Long, M. and Lowes, D. (2014b) 'Country thoughts', *Athletics Weekly*. October 30th, pp.38-39.

Mann, R., Williams, C., Clift, B. and Barker, A. (2018) 'The Validation of Session Rating of Perceived Exertion for Quantifying Internal Training Load in Adolescent Distance Runners', *International Journal of Sports Physiology and Performance*. Volume 14. Issue 3. pp.354-359.

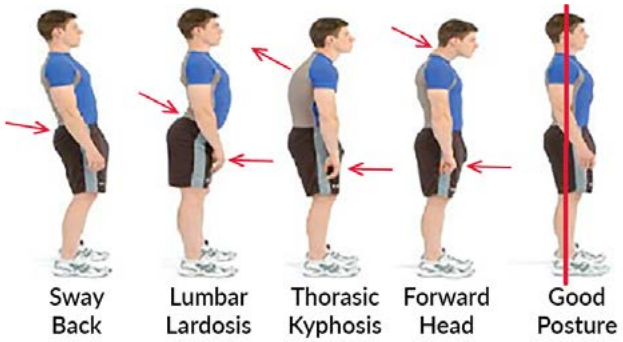
PART 4:
ENDURANCE RUNNING AS SKILL ACQUISITION

This is important for both running economy and efficiency. For the disabled athlete, for instance, blade running requires significant skill acquisition.

The following diagram (*Figure 10)* provides us with an understanding of why running posture and form is important due to the types of lifestyle which Westernised young people may be exposed to. These include:

- Relative inactivity (compared to 30 years ago) even in young athletes
- More time seated (hips flexed, knees flexed) in flexed position.
- Less time walking/running (extended position).
- More time at computers, games consoles and phones (neck flexed, shoulders rounded, upper back flexed).
- Basically much more time in activities that don't help athleticism.

Figure 10: Current Generational Challenges



In more recent years, a more refined understanding of how and why young endurance athletes need to move beyond pure running has been forged and conceptualised through the notion of 'Biokinetics' (see Thompson, 2016).

Biokinetics

'Biokinetics' is a term which is distinctive from metabolic energy systems which we are taught about on coaching courses and sports science degrees. In terms of the way in which we conceive the aerobic, lactate and alactic capabilities of athletes – we call this 'bioenergetics'.

On the other hand, the energy gained from internal kinetic sources is labelled as 'biokinetics' and is underpinned by knowledge that how the whole kinetic chain operates is critical. It requires an appreciation of elasticity and reactivity simply because all athletic events, whether running, jumping or throwing, involve rapid acceleration of force in order to move the mass of an athletic body. In terms of running, for example, the shorter the ground contact time is, the faster one can run with the same metabolic energy.

The internal elastic response with the ground which the athlete can generate releases biokinetic energy. It involves the hip, knee, ankle and foot joints and furthermore as a starting point the elastic properties of the tendon and aponeuroses need to be understood.

Tendons and Aponeuroses

An understanding of the role of tendons is important. They are shiny, white and opaque like a rope and their primary function is to connect muscles to bones. Additionally, the role of the aponeuroses is important as a white transparent sheath which acts as a collagenous connective tissue, which may involve muscles but can connect bone to bone. They both have elastic properties that can return or amplify forces, with the key difference being that tendons are uni-axial whereas the aponeuroses are multi-axial, the latter of which is pivotal when multi-directional movements are required (see Long et al. 2021).

So biokinetic development is all about securing optimal and adaptable stiffness of the kinetic chain (see Thompson, 2021). Work on fundamental movement patterns may involve bracing, hinging, squatting and lunging. This can be diversified to double to single leg squats and lunge drills. Plyometric work could involve 'pogo' and countermovement jumps, hop stick jumps, foot drills, hurdle drills to mobilise the hips, and barefoot strides (where appropriate) for balance and proprioception (see Brace et al. 2021).

The following section explores the biomechanics of the correct template for endurance running and how they are applicable to the younger athlete. It moves on to explore long, medium and short-term coaching based interventions which can assist with running form by means of mobility drills and static stretching.

The Technical Template for Endurance

The following is the correct technical template for endurance as guided by the governing body.

- **Tall posture with high hips**
  This means that the stride length can be long and also aids breathing if the upper body is not hunched over.
- **Relaxed shoulders with efficient backwards driving arm action**
  Runners who drive their arms backwards in a relaxed way will find that their arms 'pop back'. so to speak. The forward propelling arms drive the kinetic chain forwards in the direction which the athlete wants to travel, rather than energy being wastefully dispersed with the arms crossing the chest.
- **Rhythm guides optimal speed and efficiency**
  When the arms drive forward, the legs will inevitably follow in a rhythmic nature.
- **Foot lands naturally underneath the centre of mass, moving down and backwards.**
  If the foot lands in front of the centre of mass, this will inevitably lead to a breaking effect when the young athlete lands. Landing underneath the centre of mass on the forefoot, with the foot striking down and backwards with a good contact but minimal contact time on the ground, will maximise flight time in the air. Both cadence and stride length can be increased.

In addition to the above, the core and trunk are massively important. It is the ability of the transversus abdominis, both internal and external oblique muscles, the quadratus lumborum and the diaphragm to stabilise the core of the body during movement, thus allowing the limbs to move effectively giving them a stable platform to exert force. In the 2013 World Championships in Moscow, it was noticeable that Mo Farah was able to keep a relatively level and stable pelvis even during the latter part of his 10,000m final. One of the reasons why Farah was successful in this race was that keeping his hips high

allowed for his longer stride length to be maintained throughout, aiding force to be more directly transferred up through his legs, hips and upper body and thus facilitating greater forward propulsion. Grimshaw et al (2007) noted that at foot strike the hip is flexed to around 45 degrees and that during the drive-off phase the hip extends to approximately 9% at toe-off. By maintaining a tall posture with high hips, the athlete can use a more efficient stride pattern and apply force more effectively when running.

It is important for the young athlete to try and ingrain good running form way before they consider becoming event group or event specific athletes operating over the middle distances. This is intertwined with the capacity of the young person to be able to exploit various windows of skill acquisition.

Windows of opportunity for skill acquisition

In *The Physical Components of Fitness*, Peter Thompson talks about how, at the Fundamentals Stage of athletics development, there is a window of opportunity for skill development in terms of reaction movements. This can be achieved through a variety of speed-based multi-directional movements and games based on activities lasting less than 4-5 seconds, thus using the alactic energy system, with adequate recovery in between.

Girls between the ages of 8 and 11 and boys between the ages of 8 and 13 have exceptional rates of learning in the skill 'window of opportunity'. A second speed window occurs in adolescence due to the continuing development of the nervous system, now having the addition of the developing energy systems. In *The Physical Components of Fitness*, Thompson goes on to suggest that If working on speed at the Foundation level of development, athletes can be regressed from 'Flying 30s' to 'Flying 20s'. Conversely they can then be progressed on to 'Flying 30s' when at the Event Group development stage.

We know that both coach and athlete need to develop a detailed understanding of how the lever (arms and legs) movment and core stability can improve performance. But how do we begin to do this by making short, medium and long-term interventions?

Making appropriate coaching interventions

Rather than listing a pre-set number of drills which cannot possibly be athlete-centred, this section looks at short, medium and long-term interventions which coaches can make with young athletes to help improve running form.

Short-term interventions tend to be based on verbal commands and are intended to make an almost instantaneous impact on running form. One such verbal command is **"run as if you had a helium balloon attached to the top of your head".** Rather than 'telling' an athlete simply to "run tall", where the response may be "How?", this invoking of visual mental imagery is used to get athletes to focus on the process of trying to ensure that they maintain a tall posture with high hips. A second example often recommended is the command-based analogy to **"not spill the bucket of water".** Getting the athlete to visualise a bucket of water seated inside the pelvis and a forward or backward tilting pelvis 'spilling' the water helps them to maintain a 'neutral pelvis'. It also encourages the coach to develop an uunderstanding and awareness of the learning preferences of diverse athletes. A benefit of this short-term intervention lies in its power to effect immediate change. Two disbenefits are the fact

that unless athletes have some kind of pre-disposition to be auditory learners it may not work and secondly, short term interventions tend not to be as sustainable in terms of their changing and imbedding habits.

A medium-term method favoured by England Athletics Regional Coach Lead for Jumps (North), Jamie French, in his coaching at Leeds Beckett University, has been to periodically get runners to hold crisps between their fingers and thumb whilst practicing a fast, controlled approach in order that they learn to maintain both relaxed hands and shoulders. Medium-term interventions involve doing something like a drill rather than a verbal command based intervention. Medium-term interventions take a number of weeks to make a difference in performance terms.

In terms of working core stability, a dynamic plank whereby left and right legs are alternatively moved away from the core and side to side, would be an appropriate drill to be performed over a week or series of weeks of training. Other effective drills, indicative of a medium-term intervention are lateral side bends weighted with a dumbbell and medicine ball work with forwards, backwards and overhead movement. The maintenance of a level pelvis, referred to above, is dependent upon hamstring and lower back flexibility as well as hip flexor strength, so both the lengthening and strengthening of muscle groups around the pelvis is paramount. Isometric squats (holding in a desired squat position for a short period of time) can help to develop strength in this area, which also aids foot placement. In order to prevent the inward collapsing of the foot at the point of ground contact, the gripping of a towel with the toes to strengthen the foot arch is recommended.

Long-term interventions may take many weeks or even months to have an effect on correct running form. They are bound up in the frequency, intensity and volume which an athlete undertakes as part of a periodised schedule. It takes many thousands of hours of practice to reinforce skill. Having said this, if a skill is practiced badly due to fatigue, that badly practiced skill will be reinforced, rather than the technically proficient and efficient skill needed for optimum performance. So things like short 10s alactic strides effected at the end of a training session will help the running form of a young endurance athlete in the long term (see Long et al. 2015).

Questions for athlete self-reflection:

1. What am I doing to develop the skill acquisition side of running as well as the energy systems?
2. What drills work best for me to make biomechanical and biokinetic improvements?
3. When and where do my drills fit into my periodised plan of training?

Questions for coaches to reflect on:

1. When are the most appropriate windows of opportunity to develop skills with young endurance athletes?
2. What type of short, medium and long-term coaching interventions can I make to help improve the fundamental and foundational skills of my young endurance athletes?

Resources for Further Development

For visuals take a look at:

Brace, M. (2020) *Endurance- Lets Start with Drills.*

Long, M. (2021) *Endurance: Biokinetics - How to run faster without being fitter.*

Pilkington, G. and Leonard, M. (2021) *Speed: Ensuring your drills are fit for purpose*.

All these videos are available at:
www.athleticshub.co.uk/public/videofeed-all
Search using the video title.

For reading consider:

Brace, M., Long, M. and Reevell, D. (2021) 'The 'now what' of biokinetics'. *Fast Running*. 24th June.

Long, M. French, J. and Cook, B. (2015) *Biomechanical Interventions*. Available from: www.brianmac.co.uk/articles/article192.htm

Long, M, Reevell, D. and Brace, M. (2021) 'Beach of biokinetics'. *Fast Running*. 9th June. Available at www.fastrunning.com/running-athletics-news/beach-of-biokinetics/32562/amp

Reevell, D., Brace, M. and Long, M. (2021) The 'so what' of biokinetics. *Fast Running*. 15th June.

Thompson, P. J. L. (2009) *Run! Jump! Throw! – The Official IAAF Guide to Teaching Athletics*.

Thompson, P.J.L. (2016) 'Current Perspectives of Biokinetics in Middle and Long Distance Running – An Examination of the "Elastic Response" '. *IAAF New Studies in Athletics*. 31:1/2; 25-40. Available at: https://worldathletics.org/nsa/article/filter?&authorId=5461fcc71111ff42acac6c37

Thompson, P.J.L. (2021) 'Biokinetic energy – identifying the fourth energy system for all track & field events'. *Techniques for Track & Field and Cross Country*, USTFCCCA, 14 (4): 8-13.

PART 5:
STRENGTH & CONDITIONING TRAINING

This section is a continuation of Part 4 in that in order to be able to run skilfully, one has to master some fundamental movement patterns. Thickpenny (2019) articulates them as (1) Squat; (2) Lunge; (3) Push-Pull; (4) Brace and Rotate; (5) Hinge and (6) Landing mechanics. So in many ways the term 'Physical Preparation' is broader and more holistic than the notion of 'Strength & Conditioning'.

Blagrove and Hooper (2021: 304) reminds us that Strength & Conditioning (S&C) training builds agility, speed, muscular strength, balance, co-ordination and motor control: "Providing training is supervised and prescribed by a qualified practitioner, the current consensus in the field of pediatric sports medicine indicates that strength training is not inherently harmful and does not pose a risk to epiphyseal plates or normal growth". In previous research, Blagrove et al. (2018a and b) found that greater gains can be achieved in 15-18 year old endurance athletes when two running sessions per week are replaced with strength training sessions. According to the recent work of Trowell et al. (2020), strength training activities performed between 2–3 times per week for a period of between 6–14 weeks can improve measures of strength and explosive power in middle- and long-distance runners.

Blagrove and Hooper (2021) have focused on how maximal sprint speed and running economy can be improved by appropriate and progressive S&C work. They argue that high-intensity strength training performed regularly in short periods (less than 20 minutes) may help reduce the risk of certain overuse injuries as well as helping athletes who have relatively low bone mineral density, with the hip and spine being key problem areas. For youth endurance runners who may be new to strength training, the development of movement competency across a diverse range of exercises should be accorded preference. These may include squat, hip hinge, step up, lunge and hop and stick. If a short ground contact time is maintained, the latter are thought to develop neuromuscular capabilities relating to the stretch-shortening cycle and have a transferable value to endurance running. Resistance training may take the form of appropriate weightlifting and throwing activities, single or bilateral (both sides) leg loaded movements, and single joint isolation exercises. Plyometric work is based around hopping, bounding, and bilateral jumping.

It is worth noting that the residual fatigue from both resistance and plyometric modes of training can negatively impact on performance during subsequent running sessions. Adequate recovery may be required. A recommendation of at least 24 hours should be left after a strength training session before embarking upon a hard running session. If running and strength training on the same day, young endurance athletes should try and separate both activities by at least 3 hours or more where possible. Alternatively, young endurance athletes can embark upon 'micro-dosing' (Blagrove and Hooper, 2021)

where smaller chunks of work (less than 20 minutes) are effected most days of the week.

Blagrove (2020) offers a useful form of classification of S&C work by disaggregating it into (1) Movement skills training; (2) Plyometric training; (3) Resistance training and (4) Specific conditioning.

Movement skills should involve mobility, general movement patterns, running drill walkthroughs, balance training and targeted activation.

Plyometric training should cover ankle stiffness, dynamic running drills, bilateral jumping, maximal sprints and low speed hopping and bounding.

Resistance training can be comprised of bilateral structural loading, hip dominant exercises, unilateral loading and upper limb exercises.

Specific conditioning is geared towards the calf-Achilles complex, Feet, Hamstrings, Gluteals and Lumbopelvic complex. He goes on (*Ibid:* 7) to give examples of the type of work which needs to be affected under each mode of training as follows:

Movement skills:

- A walk over hurdles.
- Overhead squat.
- Band resisted walk.
- Single-leg Romanian deadlift
- Bosu balance
- Split squat

Plyometrics:

- Short sprints
- Low box rebound jumps
- Mini hurdle jumps
- Hop and sticks

Resistance:

- Med ball overhead throw
- Back squat
- Dumbbell step up
- Med ball lunge
- Press ups or inverted row

Specific conditioning:

- Pogo jumps
- Mini zig zag hops
- A skips
- Calf press holds
- Bent leg calf raise
- Single leg bridge
- Single leg prone hold
- Side plank

Questions for Self-Reflection

1. How do I break down the different modes of S&C training?
2. When in my training programme are there appropriate opportunities to build in S&C work?
3. What can I do to make sure my S&C work is progressively overloaded over a period of months and years in order that training adaptations take place?

Resources for Further Development

You need to be looking at videos so you can look at the correct technical templates for modelling drills:

Brace, M. (2021) *Endurance. Physical Prep. Conditioning for runners.*

Gambetta, V. (2020) *Foundational Strength for Developing the Resilience Athlete*.

Thickpenny, R. (2019) *National Youth Conference. Physical Preparation for Young Athletes.*

Thickpenny, R. and Rowland, D. (2020) *Physical Preparation.*

All these videos are available at:
www.athleticshub.co.uk/public/videofeed-all
Search using the video title.

To consolidate with reading take a look at:

Blagrove, R.C., Howatson, G. & Hayes, P.R. (2018a) 'Effects of Strength Training on the Physiological Determinants of Middle- and Long-Distance Running Performance: A Systematic Review'. *Sports Med* 48, 1117–1149 (2018). https://doi.org/10.1007/s40279-017-0835-7

Blagrove, R., Howe, L, Cushion, E. Spence, A., 'Howatson, G., Pedlar, C. and Hayes, P. (2018b) Effects of Strength Training on Postpubertal Adolescent Distance Runners'. *Medicine & Science in Sports & Exercise*, 50 (6). pp. 1224-1232. ISSN 0195-9131 DOI: https://doi.org/10.1249/MSS.0000000000001543

Blagrove, Richard C. PhD, CSCS1,2; Howe, Louis P. MSc3; Howatson, Glyn PhD2,4; Hayes, Philip R. PhD2 (2020) 'Strength and Conditioning for Adolescent Endurance Runners', *Strength and Conditioning Journal:* February - Volume 42 - Issue 1 - pp. 2-11

Blagrove, R. and Hooper, D. (2021) *Nurturing Young Distance Runners. The Science and Practice of Middle and Long Distance Running.* Routledge.

Trowell, D., Vicenzino, B., Saunders, N. et al. 'Effect of Strength Training on Biomechanical and Neuromuscular Variables in Distance Runners: A Systematic Review and Meta-Analysis'. *Sports Med* 50, 133–150 (2020). https://doi.org/10.1007/s40279-019-01184-9

PART 6:
ROAD RUNNING

Over the last few decades, increasingly more road running clubs have been keen to promote the benefits of endurance running to young runners. This section aims to share guidance with regards to the development of young athletes, and to provide guidance on making appropriate provision for younger runners.

Times have changed because, in decades gone by, off-track clubs have tended to attract both senior and masters runners, with junior athletes gravitating towards Track and Field clubs. This being said, it is evident that not all young athletes have easy access to a Track and Field club and its increasingly acknowledged that off-track clubs can play a key role in introducing younger athletes into the sport.

What is deemed to be 'appropriate provision' in the context of road running depends on biological and training age of the athlete. This being said, in chronological terms, athletes who are 12 years of age and above should undertake a running programme which still maintains a focus on fundamental movement patterns and skills. Diversity of athletic experience is encouraged, so running alongside fundamental jumping and throwing activities is recommended.

Off-track clubs should be aware that Leadership in Running Fitness (LiRF) trained leaders, whilst insured to work with 12 year olds or above, are only covered to deliver basic running activities and won't have the athlete development run, jump and throw components associated with the role of an Athletics Coach. When a young athlete reaches the chronological age of 12, this does not mean that the multi-events ethos should be abandoned overnight and even when endurance running becomes the primary if not exclusive focus, sprinting and drills over hurdles should form part of a healthy and diverse training programme. Resources like Athletics 365 can provide you with plenty of ideas for such activities. Coaches should avoid the tendency simply to 'water down' adult programmes for young runners.

The retention of a multi-sports and multi-event ethos inevitably means as athletes mature they may need to be appropriately signposted to a sprints, jumps or throws pathway if that becomes their preference, and this should be seen as a victory in terms of their retention within the sport rather than as a 'loss' to the endurance community without being lost from the sport.

In many areas of wider society, 16 years old are treated as adults, but England Athletics, along with most other national governing bodies of sport, consider adults to be those aged 18 years and above. Just because young runners 'can' run certain distances, for example, doesn't mean they necessarily 'should' in the sense of it being in their long-term interests. This point is exemplified when working with off-track runners who are aged 16 -18 years.

It is worth remembering that young males in particular tend to have a late growth spurt in their early twenties. An 18 year-old may not be breaking any rules by running in a Marathon, but the real damage may be done by having to incur significant mileage in training while their body is still growing, in a way that might well lead to injury problems that curtail a promising future as a runner. Indeed, physical readiness to compete is only part of the equation because mental readiness is inextricably linked with this. This is why appropriate competition pathways have been established which provide a platform for young athletes to move up the distances at the right stage of their development. Most of the leading endurance athletes who started young but may later have success at 10k or upwards will have started out as non-road running event specialists, doing much shorter distances on the track or over cross country, before focusing on longer distances in their mid-twenties or even early thirties.

Questions for Self-Reflection:

1. Why am I running on roads at a young age?
2. In what ways am I aware of the need not to specialise too early as a road runner?
3. What tools have I got available to monitor the frequency intensity and duration of the work I undertake on the roads?

Resources for Further Development:

Renfree, A. (2021) *Pacing strategy and tactics in endurance running.* I

Wilkinson, J. (2021) *Introduction to Coaching Pacing Skills.*

All these videos are available at:
www.athleticshub.co.uk/public/videofeed-all
Search using the video title.

PART 7:
CASE STUDIES

This section explores domestic case studies of what can be considered to be good practice in long-term athlete development, including Jenny Meadows and Helen Clitheroe, and more recently Tokyo 2020 Olympian Oliver Dustin. The chapter then moves on to look at an international comparison with the contemporary example of Jakob Ingebrigtsen, who is sometimes mistakenly thought to be an early specialiser who appears, at face value, to have 'bucked the trend' being advocated in these pages, before considering the experience of Paralympian Richard Whitehead.

CASE STUDY 1:
Jenny Meadows

In this short case study we look at the athlete development model from the base of the pyramid all the way up to world class performance athlete.

In terms of the Fundamental underpinnings of the ABCs (Agility, Balance and Co-ordination), Jenny has credited her ability to remain relatively injury free in a senior career with her focus on trying to train to not just run but to jump as well. She has said that, "I had a go at long jump and throwing too even though I was pretty rubbish at that! People remember I missed out on London 2012 through injury but for 23 years of my career I never had an injury – which is unbelievable – the more and more I think about it. A lot of people have said that I was a 'natural' but I'm not so sure about that. I had the fundamentals ingrained into me when I was 7, 8 and 9 years old" (see Meadows and Long, 2017).

In terms of her Foundational Development, Jenny spent her teenage years in the sprint event group as a 300m and then 400m runner. As a keen schoolgirl she wanted to train three times a week rather than just twice, but her mother said, "I still want you to be doing athletics when you are aged 20". Jenny has advised to ,"Definitely concentrate on technique and mechanics and this is far more beneficial long term than just throwing in another endurance session at a young age, the latter of which may give you quick results".

It's significant that, despite her 1995 English Schools' win over two laps, Jenny only made a concerted attempt to commit to middle distance running in 2005. Even at this stage, there was the odd 400m and 1500m thrown into her competition schedule. Jenny admits that, "It's very easy to get sucked into comparing your performances with other youngsters on Power of 10. It's really important to focus on your own maturation and development. I mean there's girls running up to 6 seconds faster than I did at the same age as me when I won the English Schools' 800m more than two decades ago".

Jenny could certainly be considered an event specialist athlete at the age of 25 back in 2006. During that season

she competed in no less than twelve 800 metre races, indoor and out, with her 2005 season's best of 2:02.05 being substantially reduced to an eye catching 2:00.16, achieved in placing 5th at the British Grand Prix in Gateshead. It was a year in which she would represent Team GB in reaching the semi-finals of the World Indoor Championships in Moscow.

One year later, at the age of 26 in 2007, Jenny began to make her mark on the international stage by placing 5th over two laps at the European Indoor Championships on home soil in Birmingham, and by reaching the semi-finals of the World Championships in Osaka. Significantly, as a performance athlete she broke 2 minutes for the first time both indoors and out, clocking 1:59.39 in Osaka. Two years later in 2009, she would claim a career-defining World 800m bronze in the outdoor championships in Berlin.

CASE STUDY 2

Helen Clitheroe

Our second case study takes a more expansive and detailed look at the stages of the athlete development model, but this time we adopt a critical pathway analysis approach by regressing from top to bottom.

Helen Clitheroe took Commonwealth bronze over 1500m in 2002 and nine years later became European Indoor 3000m champion in Paris at the age of 37 (see Long and Moses, 2021a).

Helen has always credited all the coaches she has worked under, including Terrence Mahon, John Nuttall and Trevor Painter, but is keen to emphasise the pivotal role played by Jeremy Harries, who guided her through the junior ranks and into senior success. She fondly recalls Harries as "a quiet, scientific person" whose influence was monumental. It wasn't until the relatively late age of 25 that Helen achieved her first senior Team GB vest and she distinctly recalls being in awe of the likes of Paula Radcliffe and Liz Yelling when on a training camp before a World Cross Country Championship. After taking a morning run with both, she remembers feeling shocked when the pair put on their trainers yet again for an afternoon run: "I honestly didn't know people did double days of training back then", she says with a chuckle. "Even though I went on to be quite endurance based as a senior, Jeremy rightly held me back and we only gradually built up the mileage, and looking back I'm so grateful for that".

One of the things which coach Jeremy Harries did for Helen during her formative years was to get her to work with a sprints coach, Jim Warnock (see Moses and Long, 2021). Along with the drills that Warnock and Harries devised, Helen is adamant that, "This gave me a really good grounding". This focus on running mechanics was something which Trevor Painter reinforced later in her career when she worked with World 800m bronze medallist Jenny Meadows. It's sometimes overlooked that Helen transitioned to the steeplechase and represented Team GB at the Beijing Olympics over the barriers. She believes this was instrumental in helping her achieve her success on the 'flat' 3k in Paris, adding that, "the chase gave me such a lot in terms of what I went on to achieve in the twilight of my career". With the consent of Jeremy Harries, Helen maintains that her focus on developing strength endurance was in part due to conditioning facilitated by what she terms, "Old school circuits and a bit of body pump!". This demonstrates that fitness gains can be made by non-running related activities and is one of the reasons Helen managed to avoid prolonged period of injury into her late 30s.

Now an established British Athletics Team Coach, mentor and coach in her own right, we ask Helen what she would tell her 'younger self' if she had the benefit of Michal J. Fox style *Back to the Future* time travel! Candidly she has disclosed that, "Stretching is something which I only truly discovered in my later years. Of course I wish I had done more of it earlier. Again I have to credit Trevor Painter and Jenny Meadows with this. I guess its taking care of the little things and in hindsight I should have given these things a little bit more space in my training dairy!".

"It never entered my head that I'd make it as a senior. It's fair to say I wasn't amazing as a youngster", Helen has said with candour. "I tended to run 800s in my early to mid teens and whilst I qualified for a couple of English Schools' Championships, I never made a final". 'So why not an early attraction to the 1500m' we ask?

Helens' acknowledgement that. "It never entered my head that I'd make it as a senior," is more than just a nod to her tendency to self-deprecation. Rather it is a sign that she

was immersed in healthy home and athletic environments where 'significant others' like parents and coaches did not put performative pressure on her.

Helen continues further about her progress as a late developer, acknowledging that, "I certainly wasn't living the angelic life that some fellow teenage athletes were!". Whilst her diet was good due to the cooking of her mother, she hit the town to party in her late teens but now in her late 40s, she has a different perspective on this. "I never felt like I'd missed out on anything. When I decided I really wanted to commit I just wasn't bothered about going out partying anymore. I'd already done that and got it out of my system".

It's fair to say that Helen's relaxed approach towards the sport would change over time, as former training partner Lewis Moses has recalled. "She was the model professional. I first met Helen in Portugal on a training camp in 2006 and I was immediately inspired to better myself. I knew at that point that I was not doing enough to be the best that I could be. That being said, I felt like my relaxed and non-specialised approach to the sport in my teenage years was very similar to that of Helen's and therefore I could learn a lot from her".

Even during her proverbial 'terrible teens' the key is that Helen willingly retained herself in our sport. She has asserted that, "I never stepped away from running during my teens. I was probably rubbish but I still enjoyed turning up for training". Helen has articulated that, "I just liked running basically – going to my club and competing in Mid Lancs cross country races".

With gusto Helen has said, "I did loads of different sports as a kid. I think I went to just about every after-school club going!". She has revealed that her tremendous aerobic capacity was developed through steady state swimming as a youngster (see Long and Moses, 2021b). Not only is swimming not weight-bearing, and therefore less likely to result in bone injuries compared to endurance running, critically as a non-competitive swimmer Helen's enjoyment was strictly of the process rather than any intended outcome in performative terms. When asked how these activities contributed to the development of her ABCs (agility, balance and co-ordination), she responds that, "When I look back I was always a strong, slim child. The swimming and gymnastics at an early age definitely helped me in terms of being robust". In his excellent *The Physical Components of Fitness*, Oregon based coach and IAAF coach education contributor, Peter Thompson, reminds his readership that girls between the ages of 8 and 11 and boys between the ages of 8 and 13 have exceptional rates of learning in the skill 'window of opportunity.'

Significantly, Helen has made the link between these childhood activities and her future retention of strength and conditioning as an inherent of her programme when transitioning later in her teens to becoming an event group endurance-based athlete. She has noted that, "These sports undoubtedly helped me to ultimately be able to cope with far more middle-distance specific S&C work". This is reinforced by recent research in the sports science domain, conducted by Lloyd and Oliver, (2012) which points to the wisdom of avoiding exclusive training in a single sport for more than 8 months per year or alternatively a total weekly training volume (in hours) that exceeds the athlete's age in years, until late-adolescence. This is reinforced by the work of Blagrove et al. (2020) who stress the need for the young athlete to avoid unidimensional activity, with their observation that, "Endurance training during early-adolescence (11-14 years old) should form part of an active healthy lifestyle but should not take precedence over other modalities of sport-training".

When asking her about her entry into track and field through her beloved Preston Harriers, she makes it clear that, "Even though I always knew deep down I wanted to be a runner, I still did other events". With a laugh she recalls how, "My Dad even built me a makeshift high jump in the back garden!". What is significant about this seemingly throwaway statement is that even though young athletes may know where their interests may ultimately lie – in Helen's case, the middle distances – they still should be adopting a multi-event ethos to aid their long-term athlete development. Notably she mentioned that she dabbled "with the hurdles", which of course would have a belated pay off almost a quarter of a century later when she would go on to make her second Olympic Games in Beijing in 2008 as a 3000m steeplechaser.

Helen's parting words of advice are, "The main thing is get to know the athlete as an individual and what makes them tick. That way you will learn to tell them what they need to hear from you and what they don't need to hear from you".

CASE STUDY 3:

Oliver Dustin

Having reinforced the long-term athlete development model both from bottom to top in the case of Jenny Meadows and from top to bottom in the case of Helen Clitheroe, this third case study moves away from a rigid fixation on the model to take a more fluid approach to the emerging talent of Oliver Dustin who represented Team GB at the recent Tokyo Olympics. This case study is used because, unlike Meadows and Clitheroe who are now retired from elite competition, Dustin's career is still very much in the ascendancy. What is significant about this case study is that it focuses on the critical period where the young endurance athlete may be away from home whilst studying at University and looks at good practice between club coach who retains ownership of the developmental process for the athlete long term, whilst getting the best out of the opportunity for the athlete to work with University coaches (see Long, 2021).

The relationship between long-term coach Graeme Mason, the University of Birmingham coaching team and Oliver himself saw Graeme quick to credit both Luke Gunn as Head of Athletics and University of Birmingham talent hub lead, and Dean Miller – who is instrumental in planning the training schedules for athletes. "Dean is bang on it in terms of letting us know what we can tap in to and we have a good point of contact in Ollie Armstrong, the physiologist".

Graeme is most certainly not a controlling but rather an empowering coach and this is born of his natural modesty and humility. He recalled that, "I once said to Oliver's Dad, 'We'll get him to 18 and see where we are at. Look, its essentially a hobby for me. Oliver isn't my athlete but rather he's an athlete". With a nod to the ongoing coaching contribution of Bud Baldaro and Sally Straw, he continued that, "I look at what the University of Birmingham Hub can offer as simply extending his support team in a healthy way". Oliver adds that, "The key is communication. I talk to Graeme every day which is why it still works with me being in Birmingham and him being in Cumbria".

When pressed on how he balances elite athletics with study, the chemistry student readily acknowledged that, "It's hard but the switch to online learning in recent times has been a benefit because of the flexibility which it gives me to do double days". Oliver retains deep affection for his roots in Cumbria but said, "Back home I trained with Graeme's daughter Olivia which I enjoyed. This being said when training with a whole bunch of top male athletes, I need to bring my 'A' Game with me to every single session. I can't just turn up and go through the motions".

Graeme has alluded to being influenced by a Lydiard based philosophy which is underpinned by the conviction that a solid aerobic base is a prerequisite in order to progress further up the pyramid of stimulus response based training. In addition to strength endurance through regular teenage commitment to Northern Area level cross country races was engendered with Oliver and this focus on strength endurance is credited to Percy Cerutty and still features in the Border man's schedule in terms of a mile-long hill (Uldale) which takes him 6 minutes or so to climb. Graeme continued, "I'm a great believer in variety so it's multi pace, multi-distance, multi-surface and multi-location for Oliver and my athletes. My approach is heavily influenced by the work of the late Frank Horwill who founded the British Milers' Club and the late Peter Coe who guided his son Sebastian to two Olympic 1500m gold medals". He has acknowledged that the approach of this two is dated but still relevant if refined and points to the more recent work of Jack Daniels in this context.

Up until his mid-teens Oliver played, "every single sport in the book that was going at school!" and credits this with developing what he referred to as "core skills". At 14/15, healthily he was still to specialise in terms of event group and even at during mid-teens he remembers that, "I was getting beaten in Cumbria County and County Schools events on both track and country and struggling to make county teams". Graeme is adamant that in learning to train, a teenage Oliver was made to habituate drills religiously and he is convinced that this in part accounts for the relaxed speed which the 49.0s 400m man has. With a laugh he shared that, "When he was 11 years old, I remember him blowing a gasket trying to run a 600m time trial. I turned to his Dad and said 'Don't' you worry he will make a great 800m runner one day.

Those of a certain age will remember when a young Steve Ovett burst onto the senior scene in the mid 1970s, that he steadfastly refused to chase records until his iconic rivalry with Sebastian Coe took off at the turn of the 1980s. The Brighton man who famously took Olympic 800m gold in Moscow back in 1980 would shamelessly say it was all about crossing the line first regardless of the stopwatch split. In a similar vein Graeme noting that with regards to Oliver, "He looks to win. It's the way he executes his races. He has a great finish which is there for everyone to see".

So far this season, Dustin has polished off his rivals and it remains to be seen if he can continue wiping the floor with them.

CASE STUDY 4:

Jakob Ingebrigtsen

This fourth short case study uses an international example of someone who at first sight appears not to have followed the model of athlete development as alluded to above.

Reigning European 1500m and 5000m champion Jakob Ingebrigtsen has in the past said, “I’ve been a professional runner since I was eight, nine, ten years old. I’ve been training, dedicated and following a good structure – the same as my brothers – from an early age.” At first glance this would appear to ‘buck’ the suggested trend of the model. This being said, the prodigious Norwegian has added that, “All of us have been doing football, skiing and running and a lot of different stuff. It’s definitely something to consider – start being really active and training from an early age.” Ingebrigtsen was someone who regularly effected roller skiing in a car park under his home before going to school every day and the agility, balance and co-ordination engendered in the twisting and lateral movements of this activity will have served his fundamentals and foundational development as well.

Ingebrigtsen aside, other notable international examples include former world Marathon record holder Dennis Kimmeto, who took up serious running in his mid 20s and 2012 Olympic 10,000m silver medallist Galen Rupp - a soccer player who took up running when he was 14.

CASE STUDY 5:

Richard Whitehead

Richard is a former ice sledge hockey player and competed in the 2006 Winter Paralympics in this sport for Team GB. Significantly he was a swimming teacher back in his home city of Nottingham before specialising in track and field.

In 2004, Richard entered the New York Marathon, giving himself 11 months to train for the event and not having any prior running experience (having not even run one mile!). His training began mainly by using treadmills at his local gym, and running on his knees using sports cups, before gaining confidence to run outdoors. Building up the distance and / or length of time out running started to increase, but he also had to cope with / manage the mental aspects as well as the considerable blisters encountered. Richard’s mental strength and resilience was forged at this time, inspired by his close friends, as well as his determination to complete the Marathon, which he did, and after only receiving his first prosthetic legs 13 days prior to race day!

Over the next few years Richard continued to run marathons, ultra marathons, and completed coast-to-coast runs all over the world. However, Richard was unable to compete in his favoured Marathon at the London 2012 Paralympics due to a classification ruling by the IPC and he thus transitioned to the sprints with stunning success, winning gold in the T42 200m. He repeated this feat 4 years later in Rio and ended his competitive career with no less than four IPC World championship titles.

Questions For Self-Reflection:

1. Who are my role models in the sport of track and field?
2. What can I learn from those who I look up to as a role model?
3. What do all of these Case Studies have in common, with regards to their apporach to Long Term Athlete Development?

Resources for Further Development:

Long, M. (2021) 'Dynamo Dustin Destined for Tokyo'. *Fast Running*. July 1st.

Long. M. and Moses, L. (2021a) 'Taking care of the little things'. *Fast Running*. January 6th

Long, M. and Moses, L. (2021b) 'A Little Bit of Everything'. *Fast Running*. January 13th

Meadows, J. and Long, M. (2017) 'Drill Instructor'. *Athletics Weekly*. April 27th, p.44-45

Moses, L. and Long, M. (2021) 'Making It As a Senior'. *Fast Running*. January 12th.

PART 8:
SAMPLE TRAINING WEEKS

Several of the current England Athletics Regional Coach Leads for Endurance have offered words in order to contextualise what is presented as a sample and snapshot below rather than a prescriptive schedule. To blindly follow prescribed training schedules cannot possibly be athlete-centred.

Mark Brace
Regional Coach Lead Endurance (South West):

"Long-Term Athlete Development must be a vital consideration – also the training windows for optimum development where speed, strength endurance must be highlighted in the training programme. Further it should be noted that males and females reach these windows at differing times and there is more than one opportunity but the first is vital and missing it can never be caught up in my view.

So I would advocate pyramids of progress covering skills and training that can scale athlete development. For example, the Movement pyramid should start with Fundamental Movement Skills – developing push, pull, hinge, brace, jump to body weight progression – lunge, squat, bridge. Next would be to medicine ball and resistance band progression to challenge these, then progress to single response throws and jumps to multiple responses, ending with plyometric box and hurdle movement, all of which are built into programmes specific to athlete development. The training pyramid should start with fun, but must be structured to encompass the skill windows and develop with the athlete. Progress is earned and competency-based not time managed – as you progress up the pyramid of training. The concept of super-compensation should be understood and considered, which should prompt coaches to recovery cycles within the training week for juniors. Remember what they may have done at school – recovery weeks in more comprehensive programs e.g. 2 weeks on 1 week off – which should then take into account both volume and intensity and program content. This should eventually lead to physiological considerations of affecting lactate turn point, V02 max, running economy, etc. This pyramid should be timescaled and linked to periodisation, starting very basic with long general preparation and ending perhaps with double peak competition based plans."

Darren Reevell.
Regional Coach Lead Endurance (North):

"When looking at these schedules, note a caveat around training age when it comes to volume and type in each age group. For example, if an athlete has a chronological age of 16 but a training age of less than 2, they may need to spend some time gradually building skills and volume before they are ready for the load you prescribe.

Another area to consider is recovery. Building blocks of recovery into the programme across all age groups is important as it aids the athlete's ability to make physical adaptations and helps to prevent physiological and psychological burnout. I know from personal experience that talented athletes often do multiple sports, and at times these sports may place an increased demand on the athlete. During these times it is important that coaches adjust the training volume for the athlete."

Jo Wilkinson.
Regional Coach Lead Endurance (South East):

"Any schedule needs to emphasise the importance of minimising the number of training days and building in a progression of days with age. The other aspect to be aware of is that sometimes it can be the volume within each session rather than just the number of days which creates over-training issues in young athletes".

Under 13s

Under 13 training is underpinned by the conviction that athletes should be doing running-specific work up to 3 days a week. This does not mean that they will do no physical exercise on the 4 so-called 'non-running' days. Realistically they will do some mode of exercise in PE lessons and undertake sports in a variety of different clubs. Remember, this is to be encouraged, but the athletics coach must be aware of the total loading undertaken by young people across the multiple sports which they undertake.

Note that one specific session a week which is athletics club based should involve foundational and fundamental work across running, jumps and throws. The unstructured fartlek is a good introduction to gentle speed play, with the athlete being encouraged to move up and down the gears of a bicycle. The unstructured fartlek is the one session which challenges all three energy systems and is its 'playful' nature is retained it will not unduly overload the young athlete.

Winter

Work should be undertaken off road, on track and cross country racing is desirable. This can be interspersed with junior parkrun as long as the athlete is not racing or using parkrun as a time trial every single week.

Under 13s winter schedule	
Monday	Rest
Tuesday	Athletics 365- Run/ Jump and Throw in one session
Wednesday	Rest
Thursday	15 minute unstructured fartlek
Friday	Rest
Saturday	Cross Country race or Rest
Sunday	Junior Pparkrun or Rest

Summer

Summer work retains a run, jump and throw ethos both in training and also the athlete is encouraged to compete across event groups at this stage. Repetition work can be undertaken once a week with the young athlete being given relative generous passive recoveries. The lactate system tends to be underdeveloped in pre-pubescent children but it can be worked in this way appropriately.

Under 13s summer schedule	
Monday	Rest
Tuesday	Athletics 365- Run, Jump and Throw in one session
Wednesday	Rest
Thursday	Pyramid session on track e.g. 20s/40s/60s and back down again with 2 mins passive walk recovery
Friday	Rest
Saturday	Rest
Sunday	Athletics meeting – running together with a jump or throw

Under 15s

Under 15s should be able to run 4 days a week, but having a couple of days passive recovery a week is important. At this chronological age athletes may well still healthily be engaging in multi-sports and this needs to be factored into the planning of the coach.

Winter

In the winter hill work is formalised with an aerobically based session (namely Kenyan hills). For the first time formal S & C sessions are introduced on a weekly basis and in addition we see the need for an aerobically dominant long run which should be effected on grass or trail.

Under 15s winter schedule	
Monday	Rest
Tuesday	Unstructured Fartlek
Wednesday	S and C work
Thursday	Technical / Physical Preparation (Athletics 365) Session
Friday	Rest
Saturday	Cross Country race or Rest
Sunday	Long run (off road) or Rest

Summer

The summer training needs to consist of repetition training in order to challenge the developing lactate system but this should not be effected too often. Equally important are aerobic intervals which are to be carried out with an active float recovery. The float recovery which is run faster than a jog begins to teach the young athlete how to effectively distribute and utilise lactate as a productive energy source.

Under 15s summer schedule	
Monday	Rest
Tuesday	Aerobic intervals with a float recovery
Wednesday	S and C work
Thursday	Technical / Physical Preparation (Athletics 365) Session
Friday	Rest
Saturday	Track race
Sunday	Long run (off road)

Under 17s

Under 17 athletes can run up to 5 days a week, and by their mid teens these young people may well be ready to begin to specialise on athletics as their sport of choice. If they are undertaking multi-sports it may well be non-competitive.

Winter

During the winter, the focus should be aerobically dominant and strength based work using variable types of running sessions such as 'out and oack' runs and the traditional ‘fartlek’ rather than ‘hilly fartlek’ sessions.

Under 17s winter schedule	
Monday	Rest
Tuesday	Out and back run (aerobically dominant bit with negative split)
Wednesday	Recovery run/ S and C work
Thursday	Technical / Physical Preparation (Athletics 365) Session
Friday	Rest
Saturday	Cross country race
Sunday	Long run

Summer

Under 17s summer schedule	
Monday	Rest
Tuesday	Aerobic intervals (long reps with a short roll on recovery)
Wednesday	Recovery run/ S and C work
Thursday	Technical / Physical Preparation (Athletics 365) Session
Friday	Rest
Saturday	Track race
Sunday	Long run

Under 20s

Under 20s can commit to up to 6 days a week training and 'out and back' runs can be diversified into progression runs which are effected at a range of aerobically dominant paces. We can also see the potential to work two different modes of training in one session e.g. Tempo (aerobic endurance) combined with hills (strength endurance).

Winter

Under 20s winter schedule	
Monday	Rest
Tuesday	Progression run at a variety of aerobically dominant paces
Wednesday	Recovery run/ S and C work
Thursday	Technical / Physical Preparation Session
Friday	Recovery run
Saturday	Cross country race
Sunday	Long run

Summer

Under 20s summer schedule	
Monday	Rest
Tuesday	Aerobic intervals (long reps with a float recovery)
Wednesday	Easy Run / S and C work
Thursday	Technical / Physical Preparation Session
Friday	Recovery run
Saturday	Track race
Sunday	Long run