

# Base endurance: move forwards with reverse periodisation!

## At a glance

- The concept of endurance in terms of energy systems in the muscles is explained;
- The conventional 'long and slow' method of building endurance is compared and contrasted with a lesser well-known method called reverse periodisation and the potential advantages and disadvantages are described;
- A practical guide to using reverse periodisation is given.

**The conventional approach for endurance athletes seeking new personal bests is to build an aerobic base using large volumes of low-intensity training, then to sharpen up to build speed and competition fitness. However, according to Nick Grantham, it doesn't have to be this way because there's an alternative known as reverse periodisation...**

## What is endurance?

Endurance is simply the ability to resist fatigue, and fatigue in its simplest terms is the inability to sustain a given power output or speed. When the demand for energy from the working muscles is greater than the supply, you will either have to stop, or reduce the workload (*ie* slow down). The body has four ways to generate energy for the muscles so they can perform exercise. The four 'energy producing' processes are:

- ATP-CP system – uses adenosine triphosphate (ATP) and creatine phosphate (CP) stored within your muscles to provide energy for short sharp bouts of exercise. This is your instant energy;
- Anaerobic (lactic) system – anaerobic means 'without oxygen' and this system involves the breakdown of carbohydrate without using oxygen;
- Aerobic system (glycolytic) – this system generates power for muscle contraction from the breakdown of carbohydrate in the presence of oxygen;
- Aerobic system (lipolytic) – this system generates power for muscle contraction from the breakdown of fat in the presence of oxygen.

However, you never use exclusively one of the four systems. All exercise uses a combination, but the contribution from each system varies according to the intensity level of the exercise and the body's fuel supply (*see figure 1*).

## Periodisation

The principles of periodisation, based on Eastern European ideas and methods, are the foundation of many athletic training programmes. However, surprisingly little is supported by scientific research, despite the fact that periodisation is widely used and widely written about, despite the

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numerous presentations on this topic, and despite the fact, based on practical observation, that it apparently works<sup>(2)</sup>.

Tradition dictates that to be successful in endurance-based sports you need to complete high volumes of training. The traditional approach is to move from high volume/low-intensity work to low volume/high-intensity work. Basic periodisation also moves from general to more specific work as the competition approaches<sup>(3)</sup>. This is a popular method and is heavily featured in the classic book by Tudor Bompa (*Periodization: Theory and Methodology of Training*)<sup>(4)</sup>. But what if intensity and not volume is really the key for unlocking your endurance potential?

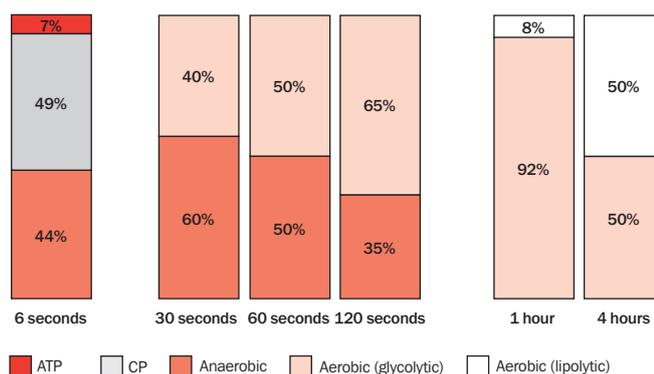
A popular quotation, often attributed to Albert Einstein, is the definition of insanity as 'doing the same thing over and over again and expecting different results'. When you read this, you probably thought, 'Well, that's obvious; of course you can't expect to get a different result by simply doing the same thing over and over again'. However, I'm constantly amazed how often I see sportspeople doing exactly that.

This is not to say that classical approaches should be scrapped altogether, but in events where local muscular endurance is required, for example in swimmers, runners, cyclists, rowers and triathletes, reverse periodisation may be the better option<sup>(3)</sup>. The same can also hold true for athletes competing in team and combat sports.

## Changing paradigms

Ian King, an Australian strength and conditioning coach, offered an alternative to the traditional model of endurance training in his book *Foundations of Physical Preparation*. In particular, he presented an alternative to the periodisation model, which he called 'reverse periodisation'.

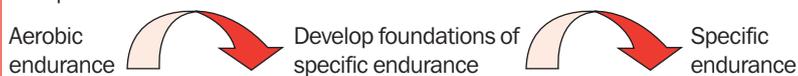
**Figure 1: Energy systems and contribution during exercise**



Hawley, J and Burke, L (1998)

**Figure 2: A traditional model for the periodisation of endurance**

1. Develop an ‘aerobic base’
2. Develop foundations of specific endurance (threshold work)
3. Carry out specific endurance work, together with and speed and power training
4. Taper



Ian King describes his approach thus: ‘The “reverse” approach is based on maintaining intensity closer to that which the competition demands (recognising that initially, the athlete’s capacity to perform this intensity will be low) then to increase the volume progressively, without sacrificing the intensity. In summary, the goal is for the athlete to learn how to run fast over a distance that they are capable of running fast over, then to increase that distance. The difference in approaches of these two models is essentially this: the traditional model commences with capacity (volume) and shifts towards power (intensity). The alternative model, as the name suggests, reverses this approach, commencing with power then shifting toward capacity.’<sup>(5)</sup>

Although there’s a relative lack of research into the whole area of periodisation, this alternative approach makes intuitive sense, and people who made a living from coaching athletes such as Charles Poliquin and Istvan Bayli continued to contribute to its design and use. Here was a training method that could be applied across a wide range of sports, from endurance events such as swimming and running to team and combat sports.

The model for reverse periodisation can be traced back to the ‘Eastern Bloc’ days. In his book *Speed Trap*, track coach Charlie Francis (who clearly understood the importance of training intensity) discussed how East German sprinters began their training at top speed over short distances, before increasing the distance as the season progressed. This training methodology was not reserved purely for sprinters; it was also used by East Germany’s competitive swimmers, who completed tough workouts in an endless pool<sup>(6)</sup>.

Ian King’s argument was that what worked with speed and power athletes could also be of benefit to any sportsperson taking part in events that require an element of endurance. Key to his

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rationale is the concept that speed endurance must be developed at the appropriate pace.

The revised method pretty much flipped the more traditional approach on its head. Athletes using this method bypass the ‘aerobic base’ work of the traditional model (see figure 1) and start by training specific endurance and speed/power training before moving on to threshold work and then tapering (see figure 2). At no point are they moving slowly for long durations. This is significant, because while the traditional approach of developing an ‘aerobic base’ focuses on the central adaptations of the cardiovascular system (heart and lungs), it pays scant regard to the muscles used to actually move the body! As Ian King makes clear in his text on the subject, sports conditioning is not just about endurance, and certainly not just about the heart and lungs.

The demands placed upon the musculoskeletal system at slow speeds are totally different to the demands placed upon it when working at higher intensities. It’s a lot therefore to expect an athlete to spend months plodding around building an aerobic base, and then to suddenly crank up the speed and start working at higher intensities as the competition season approaches. This is because you are essentially asking the musculoskeletal system to re-programme itself to cope with the increase in training intensity, yet the development of endurance goes hand-in-hand with the functional specialisation of the skeletal muscles<sup>(7)</sup>. The reverse periodisation theory says that if you want to compete at a certain intensity, why not start at that intensity and then build the volume; not only will you get central adaptations that will go a long way to developing a great heart and lungs, you will also develop the inter- and intra-muscular coordination required to compete at the appropriate intensity.

**In practice: endurance sports**

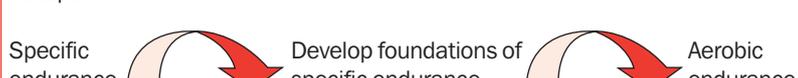
It is beyond the scope of this article to provide detailed training plans for all endurance sports (eg running, swimming, cycling, etc), but this section should provide you with some guiding principles that can be applied to any endurance sport. For the purpose of this next section it is useful to understand what intensity you should be working at and when. Box 1 (see opposite page, top) provides an outline of six training levels. This is just one system; you can work within your own training intensities as the underlying principle of developing power/intensity before capacity/volume remains the same.

A traditional plan may start off with sessions focusing on Level One (L1) work (long, steady efforts) before moving on and adding in L2/L3/L6 work, then later hitting L4 and building to L5.

If you adopt the reverse periodisation approach, you can flip things on their head. You start with L4 and L5, and then add L3. After these blocks you add L1/L2 and L6. You then cycle back to the L3/L4/L5 as a focus later in the season, either right

**Fig 3: Reverse periodisation of endurance**

1. Development of a ‘speed and power base’
2. Develop foundations of specific endurance
3. Combination training (variety of duration/specificity)
4. Taper



**Box 1: The six training levels (L) for endurance sports**

- **Level One (endurance: 3+ hours)** This level is pretty much where most people naturally default to. You are not going to stress the body enough to improve your aerobic fitness
- **Level Two (aerobic capacity tempo: 45mins+)** This level can be considered as your tempo workload and this is where you will start to make gains in your aerobic capacity
- **Level Three (aerobic capacity – lactate threshold: 8-20mins)** This is your lactate threshold (LT) work, where you increase the level you can work at before lactic acid builds up and stops you. LT training is one of the most important areas for training gains
- **Level Four (maximum aerobic power – VO<sub>2</sub>max: 3-8mins)** This is a borderline anaerobic level where you increase your VO<sub>2</sub>max, which helps train the body to clear lactic acid more efficiently
- **Level Five (anaerobic capacity: 30s-3mins)** This level is anaerobic, high intensity and where the demand for energy surpasses that which can be supplied by aerobic system. This training is often combined with Level Four training;
- **Level Six (anaerobic power (about 10s))** At this level you are sprinting. This is a level (extremely high intensity) that needs to be trained all year round.

before or right after events, or both. The idea behind reverse periodisation is that you develop your power first, and then you train yourself to maintain it. Then you add it to your normal base/tempo sessions that act as race simulations.

**Team and combat sports**

The endurance fraternity have not been the only ones to adopt the traditional method of developing endurance. But just because a football match lasts 90 minutes and a rugby match lasts 80 minutes does not mean you have to be able to maintain a constant workload for those time-frames. The same also applies to boxers and other combat athletes. Just because a boxing contest may last for more than half an hour, it doesn't mean you have to get up at 5am for a six-mile run! You fight in three-minute rounds and your workload during each round is intermittent in nature. Reverse periodisation is a much more sensible approach for getting match- and fighting-fit. Here is a suggestion for developing endurance in team and combat sports.

A traditional endurance plan for team/combat sport would almost certainly start off with sessions focusing on developing long-term aerobic endurance before moving on and adding in some short-term aerobic endurance. Once the base has been established, more time would be spent developing anaerobic capacity before finally working on what is arguably the most important endurance sub-quality for team and combat sport, anaerobic power.

Adopting a reverse approach, however, makes more sense. When I train my team and combat sport athletes, we start with very short, high-intensity efforts to develop anaerobic power. We then spend time on establishing anaerobic capacity before finally developing aerobic power and capacity (see table 1).

As we move closer to the business end of the season, we start to mix things up and add a variety of sessions that tax all of the endurance sub-qualities, in much the same way as those you would experience during a match or bout.

**Conclusion**

This article is not suggesting that we completely scrap the more classical approaches – simply that,

**Table 1: An overview of the endurance sub-qualities that team and combat sport athletes need to emphasise**

Sub-quality		Work	Ratio of work to recovery	Duration	Frequency	Intensity
Anaerobic	ST	10-60 secs	1:0.5-1.3	*15-30 mins	1-4 per week	Depends on the purpose of training, but for intervals 70%+ MHR
	LT	60-120 secs		*15-30 mins		
Aerobic	ST	2-6 mins		30+ mins		
	LT	6+ mins		30+ mins		

LT = long-term; ST = short-term; MHR = maximum heart rate  
\*Does not include warm-up or cool-down or recovery periods.

if you have fallen into the trap of repeating yourself year after year, now may be a good time for a different approach. For example, if cycling or running is your thing, you'll be very aware of the short days during the winter months and the problems of trying to train outside in the dark. With a reduced 'after-work' training time available, it makes sense to train more intensely during the winter and to increase the longer rides and runs as the evenings draw out – exactly the approach of reverse periodisation. So maybe it's time to stop following the crowd and try something new in your training methods – after all, what have you got to lose? You may find you have plenty to gain...

**Nick Grantham is a strength and conditioning coach who has worked with elite athletes for the past 10 years. He has trained many of the country's elite athletes, including Olympic and Paralympic finalists, and professionals in a multitude of sports. He now heads the Strength and Conditioning team at GENR8 Fitness**

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**Practical implications**

- Experienced endurance athletes with a good existing aerobic base may gain performance advantages with a reverse periodisation approach, particularly where speed is also required
- Reverse periodisation is less suitable for novice or very de-conditioned athletes and should therefore be used with caution.

The forward bias reduces the potential barrier of the diode and establishes the easy path for the flow of current. While in reverse bias the potential difference increases the strength of the barrier which prevents the charge carrier to move across the junction. The reverse bias provides the high resistive path to the flow of current, and hence no current flows through the circuit. Content: Forward Biasing Vs Reverse Biasing. Comparison Chart. Definition. Reverse periodization flips that timing. Athletes start in more of a build phase, doing the shorter, more intense efforts first to build their power. Then they move to the aerobic phase and add mileage to build their aerobic capacity. Chris Pilone is a 17-year veteran coach from New Zealand who coached Hamish Carter to an Olympic gold medal in 2004. He describes reverse periodization like this: "It means a period of more intensive training which could last for varying lengths of time (4-12 weeks) and then moving onto a period (again 4-12 weeks) of higher volume and more moderate training." The