

# FIND YOUR TEMPO

*The lactate threshold, or tempo run, has traditionally been hard to define, but here's why it should be an essential part of your schedule*



**THREE DECADES AGO**, a team of exercise physiologists led by Bertil Sjodin of Sweden's National Defence Research Institute put eight distance runners on treadmills. First, the scientists tested the runners' blood at various paces, focusing on lactate, a chemical thought to correlate with racing performance. Then they asked the runners to do weekly 20-minute training runs at a pace they called vOBLA – the speed at which there was an 'onset of blood lactate accumulation' (OBLA) – what we call tempo runs.

The results, published in the *European Journal of Applied Physiology and Occupational Physiology*, hit the 1980s running community like a bombshell. After 14 weeks of such training, the runners saw their OBLA paces drop by four per cent, from 5:43 per mile to 5:29.

Sjodin's was one of several studies to highlight the tempo run as a critical element in training. But it also produced the misconception that there is one perfect pace at which these runs should be done – and that the best way to do them is to find that pace and stick to it for about three miles. That single-minded focus, however, isn't what the latest exercise physiology shows, nor what many top runners are actually doing.

## PERFORMANCE PREDICTOR

One of the reasons runners have focused specifically on OBLA for so long is that it appears to be an important predictor of racing performance. 'It gives some idea of where someone's critical power is,' says John Halliwill, an exercise physiologist at the University of Oregon, US, who defines 'critical power' as 'how intensely you can exercise for a sustained time'.

OBLA is also one of the easier performance parameters to change – much more responsive to training than  $VO_2$  max, for example. In fact, in Sjodin's study, the runners'  $VO_2$ -max measurements didn't budge.

Jack Daniels, legendary running coach and the author of *Daniels' Running Formula*, defines 'critical power' more specifically, as about the pace you can hold in a one-hour race

– for most of us it's between 10K and 15K.

Other studies have looked directly at the correlation between vOBLA and racing performance. The most recent comes from a group led by Jordan Santos-Concejero, when he was a researcher at the University of the Basque Country in Spain. In a 2013 examination of 22 competitive runners (average 10K time 31:35), the researchers found a strong correlation between vOBLA and 10K times. Specifically, their data revealed that each 10 seconds per mile difference in vOBLA correlated to about a 70-second difference in 10K PB.

These correlations are why runners and coaches have long been interested in doing workouts at or around OBLA pace. That said, there has also been confusion over precisely what 'at or around' means. →



**Tempo workouts****CLASSIC TEMPO**

Warm up for 10 mins, then run 20 mins at the fastest pace you could sustain for an hour. It should feel 'comfortably hard'. Cool down with 10 mins of easy running. Extend the duration as your fitness improves.

**TEMPO INTERVALS**

After a warm-up do 2 x 10-min fast tempo runs, with a one-min recovery between them. The recovery allows you to maintain the quality throughout.

**30-MIN PROGRESSION**

Warm up for 10 mins, then do a 30-min run. Start off at a pace about one min per mile slower than 10K pace, then speed up by 10-15 secs per mile every five mins so you're running at or just under 10K pace for the last five mins.

**TEMPO 60/60**

After a 10-min warm-up, run 15 mins at tempo pace, then 15 mins alternating 60 secs hard and 60 secs at tempo pace. By the last one-min effort you should be aiming to get near your maximum heart rate. To reduce the intensity, the alternating part could consist of hard and easy – rather than tempo – efforts.

*Hard to define, hard to ignore: find the time for your threshold sessions.*

## CHANGING A REPUTATION

Only exercise physiologists use the term OBLA.

Coaches and runners say 'lactate threshold pace', 'threshold pace' or simply 'tempo runs'.

Breaking through the confusion begins with understanding the role of lactate in muscle metabolism. Lactate is a chemical with a bad reputation, associated with running too long at anaerobic paces. It has been blamed for everything from sore muscles to the dead-legs feeling you get at the end of fast-paced intervals. But none of this is true. Lactate is simply a by-product of glucose metabolism and is produced any time you move a muscle.

At low exercise levels, you use lactate nearly as quickly as it's formed, and the amount that leaks from the muscles into the blood is minuscule.

At higher levels – eg moderate-paced running – you produce it more quickly but also use it more quickly. More gets into the blood, but not much.

Around marathon pace, things change. By this point, the lactate level in the blood has edged up to about two millimoles per litre (mmol). That's still low, but if you continue to speed up, it rises more rapidly. By the time you've reached Daniels' one-hour race pace, it's doubled to four mmol, the classic threshold level. Above that, it skyrockets.

Mounting lactate levels sound like a bad thing, but research says they aren't. George Brooks, an exercise physiologist at the University of California, US, discovered what is now known as the 'lactate shuttle'. He found that when lactate climbs, the body uses the blood to

*While threshold training should be challenging, it should not test you to your limits.*

## FIND YOUR THRESHOLD

You don't have to go to a lab to find your threshold pace. Here are five other DIY methods

## FEEL

Alberto Salazar described the classic 20-minute tempo-run pace as 'fun fast'. Layne Anderson, at the University of Iowa, US, says it 'feels like a 75 per cent effort'. If you are able to hit a pace consistently and feel it was a challenging effort, you are probably running at your threshold. If you can't sustain the pace, or have too much left in the tank at the end, you were running too fast or too slow.



ship some of it away from the hard-working muscles where it is produced to places where it can be used more effectively. One of these is the heart, another is the brain. But it also goes to the liver, which can use other energy sources such as fat to turn it back into glucose. Even some less-involved muscles, such as the arms, pull lactate out of the blood for fuel, in lieu of glucose.

This shuttling makes it possible for you to run faster, because glucose is the body's high-octane fuel. We can generate energy much more rapidly with glucose than through lactate. So rather than being a sign that our leg muscles are drowning in performance-impeding lactate, the rise of lactate means the body is moving it to places where the power demands are lower, keeping the glucose for the running muscles. 'The organs that most need it get priority and others rely on lactate,' says Halliwill.

That said, rising lactate and increasing fatigue go hand in hand, which means that even if lactate is no longer the evil we once thought it was, finding ways to train the body to use it more effectively – in essence, postponing the point at which blood lactate starts to rise – will also postpone

the point of fatigue, with the hope of running further, faster. This, in fact, is what threshold training, in all of its confusing forms, is designed to do.

#### EFFICIENCY TRAINING

Nobody knows why running at or near lactate threshold makes the body's lactate processes more efficient. But training at this level can shift the entire lactate-increase curve to higher speeds.

Most coaches say the key is to run at what feels like the right effort level (see *Find Your Threshold*, below.) 'It would be hard to find definitive studies that said this is the one true way,' says Halliwill. 'What we can say is that when people train through a variety of approaches, whether it is lactate threshold or interval training at higher intensity, we see that critical pace – threshold – shift to higher intensities.'

'I believe in threshold running,' says Bob Williams, distance coach at Concordia University in Portland, Oregon, US. 'It helps the athlete feel that sense of toughness they experience when they compete. I think it's a process of adaptation, psychological as well as physiological.'

Some coaches talk more in terms of progression and effort than trying to dial into a specific pace. Scott Simmons, coach of the American Distance Project in Colorado Springs, US, says that traditional threshold runs don't mimic racing anyway, because in racing you're rarely running precisely at threshold. 'Whether it's the mile or the half marathon, you're pushing through that threshold because that's what the competition demands,' he says.

Simmons is a fan of progression runs. Such runs, he says, might start out a minute per mile slower than 10K race pace, then increase mile by mile until the final mile is at goal pace, or faster. Simmons says that such runs should not be too intense. 'It's not that extreme a workout,' he says. 'We want to incorporate the specific demand of the race, but we don't want the training to be a race.'

If you do the same workout over and over, you may become very good at it, but your overall progress will stagnate. In other words, the blurry definition of 'threshold run' can work to your advantage. The nice thing about the confusion over threshold is that it offers a huge variety of workouts, so there's something for everyone.

#### RACE PACE

Under race conditions, most runners can run about 50-60 minutes at lactate threshold, says Jack Daniels. For elites, that's roughly half-marathon pace. For age-group competitors, it might be 10-mile or 15K pace. For others, it might be 12km or 10K pace.

#### CONCONI TEST

Based on a 1982 paper by a team led by Italian researcher Francesco Conconi, this test uses a heart-rate monitor. At slow-to-moderate paces, heart rate increases linearly with pace. But there comes a point where that no longer holds and your heart rate starts to level off, no matter how fast you run. The point where this occurs, Conconi says, is your lactate threshold.

#### 3,200m TIME TRIAL

In a 1987 study a team led by University of Virginia researcher Arthur Weltman attempted to correlate 3,200m time-trial paces with lab-measured lactate-turnover paces. The formula is: threshold pace (in metres per minute) equals 509.5 minus 20.82 × 3,200m time in minutes. Their results have an 11:56 time trial over 3,200m (12:00 for 2 miles) translating to a threshold pace of 6:10 per mile.

#### 30-MINUTE TIME TRIAL

Like the Conconi test, this one is heart-rate based. Triathlon coach Joe Friel argued that to find your lactate-threshold effort level you monitor your heart rate during a 30-minute solo time trial. During the first 10 minutes, your heart rate will speed toward the lactate-threshold plateau. It's the average heart rate during the final 20 minutes that matters.

#### THE WINNER?

In a 2005 study, 27 distance runners and triathletes did the last four of these tests, then compared the results to lactate blood work determined on a treadmill. The conclusion: the best was the 30-minute solo time trial.