Slow Down To Speed Up: Base Training to Build Endurance and Boost Speed

Part Two

Part One of this series examined the first of three attributes that are common to runners who are fast at long distances: the ability to store and conserve glycogen and use fats for fuel. This second part of the series looks at the two other attributes, namely a **high lactate threshold** and **high maximal oxygen uptake**. In addition, this article provides some tips on using a **heart rate monitor** for base training.

Some of the terms in this article are introduced in Part One. Rather than explain those terms again here, it is recommended that you read (or re-read) that article as needed, which is found in the May/June 2007 issue of "Running Austin."

What is the "Lactate Threshold" and why is it important?

Lactate is produced by the body constantly. It is the byproduct of **glycolysis**, which is the breakdown of carbohydrates into energy. Right now, as you read this, there is lactate in your bloodstream. Lactate is not a bad thing or a "waste product" - indeed, your body uses lactate for energy production.

Another byproduct of glycolysis are **hydrogen ions**, which are used by the body - in the presence of oxygen - to produce water, or H2O.

Lactic acid, which is the byproduct of anaerobic respiration, is not a "waste product" as some people think. Once exercise ends, lactic acid enters the bloodstream and loses the hydrogen ions that make it acidic. However, anaerobic respiration leads to an accumulation of hydrogen ions, which create an acidic environment that interferes with the breakdown of carbohydrates into energy, slows the muscle functions, and irritates nerve endings (the muscle "burn" associated with extremely hard exercise).

So why the emphasis on "lactate threshold"? Remember that your body is producing and consuming lactate constantly. As exercise intensity rises, the production and removal of lactate and lactic acid increases. But there is a point where the *production* of lactate and lactic acid exceeds the body's *consumption* rate. That is the "lactate threshold," or "LT."

The biochemical effect of crossing that threshold is complex. In basic terms, think of the LT as the point at which the body can no longer efficiently remove the hydrogen ions from the blood and muscles.

Since high levels of lactate and hydrogen ions are detrimental to performance, the importance of aerobic capacity is highlighted - higher levels of oxygen to the muscles during exercise means less production of lactic acid, which in turn minimizes the negative effects of the hydrogen ions in lactic acid.

How do you increase aerobic capacity? Long, slow, steady runs. Yes, there are training methods that take runners up to and beyond their lactate threshold, which are designed to push the LT higher. But these "LT workouts" should be saved for the training period weeks down the road - after the aerobic base is established. The foundation to improving performance is the ability to deliver oxygen to the working muscles. In that regard, nothing beats long, slow runs.

The delivery of oxygen to the muscles, a.k.a. VO2max

VO2max refers to the ability of the body to move maximum amounts of oxygen to the muscles, and the muscles' ability to extract and use that oxygen. The "V" refers to volume, and the "O2" is oxygen.

Long, slow running increases the heart's stroke volume, increases capillary density in the muscles, and triggers the production of more mitochondria in the muscle cells - the "powerhouses" that convert fuel into energy. Aerobic training can boost these adaptations significantly, turning a runner into a fat-burning aerobic machine.

Depending on an individual's overall fitness, aerobic training can increase VO2max by up to 20-25%. Over a period of weeks, running the same distance at the same pace requires a lower breathing rate and, in turn, a lower heart rate during exercise.

There are extremely accurate ways to measure lactate threshold and VO2max, but these require a controlled environment, blood sampling, and equipment that typically is not available (or convenient) for daily training out on the roads and trails. Instead, it is more convenient to train using a method that keeps the runner inside specific "zones," particularly the aerobic zone. In that regard, runners ask the same question...

"How hard am I supposed to run?"

This is the "million dollar question" for runners who seek to boost aerobic capacity. Many coaches instruct runners to keep a "conversational pace" or to use a low "RPE" (rating of perceived exertion) for aerobic work. These certainly are useful guidelines, but one of the handiest tools available to runners is the **heart rate monitor.** There are a multitude of brands and models on the market today, but for basic aerobic training all you need is something that accurately measures your heart rate during exercise.

A quick scan of various training books, programs, and running websites will yield a range of recommended "heart rate zones" for aerobic training. Generally, the recommended ranges are anywhere from 60%-80% of maximal heart rate. That's not very useful. For one thing, what is "maximal heart rate"? Some coaches advise "220 beats minus your age" as maximal heart rate. For a 40 year-old runner, this is 180. Thus, 60%-80% of 180 is 108-144. In other words, running between 108-144 beats per minute would be considered the "aerobic zone" for our 40 year-old using these simple methods of calculation.

Again, this is not very useful, especially if the runner is already well conditioned (or, conversely, is poorly conditioned and can hardly walk a brisk pace at 144 beats per minute). Accordingly, most heart-rate training methods will require you to perform some sort of test to determine your maximal (or sometimes called "maximum") heart rate.

A better measure for using a heart rate monitor is **Heart Rate Reserve**, or "HRR." HRR takes into account a runners *resting* heart rate as well as *maximal* heart rate. Why is that different from operating strictly from maximum heart rate? For one thing, everyone has different resting heart rates depending on gender, level of fitness, and so on. Likewise, two 40 year-olds can have markedly different maximum heart rates, again depending on gender, body composition and overall fitness.

Heart Rate Reserve is an individualized way to determine your body's ability to go from a state of rest to maximum effort. It sounds complicated, but is not. Below is a simple way to calculate HRR using a heart rate monitor.

How to calculate your "Heart Rate Reserve"

First, find a moderately steep hill that is 600-800 meters long (about one-third to one-half of a mile long). In Austin, you can find these hills lots of places, like Jester, Scenic, Mt. Bonnell, and Lost Creek. Do a 15-20 minute warm-up run at an easy pace on a flat or rolling course - just enough to break a sweat. Finish the warm-up at the base of the hill, start the heart rate monitor, and begin the first of three consecutive climbs up the hill. Each climb should be at a progressively harder pace, i.e., hard, harder and hardest. At the end of each climb, stop only for a moment, turn around, and jog easily back to the bottom of the hill.

During the middle and at the end of each climb, note your heart rate, and be sure to make a mental note of the maximum. By the time you complete the third *and hardest* climb (doubled over, very much out of breath), you should have hit your "maximal" heart rate. Keep in mind that you might be surprised by a relatively "low" number, like 172-178, especially if you perform this test in the morning, while hydrated and well-rested. That is perfectly fine.

Next, you need to measure your resting heart rate every morning - before getting out of bed - for several days. The easy way to do this is to keep your running watch by your bed, find your pulse when you wake up, and count for 60 seconds (the hardest part is remembering to do this). Record your resting heart rate, and get an average for the week.

Let's say for the purposes of illustration that our runner is a 40 year-old who attains a maximal heart rate of 175 on the hill test. Next, she averages 55 beats at rest. HRR is maximal heart rate minus resting heart rate. In this example, 175 minus 55 is 120. That is her "heart rate reserve," 120. In other words, she can go from complete rest at 55 beats per minute to a maximum of 175 beats at very hard effort.

Generally, the recommended zone for aerobic training is 65%-78% of HRR. For our example, where the HRR is 120, we arrive at these numbers:

65% of 120 = 78
78% of 120 = 94

However, you have got to *add* back into these numbers the resting heart rate. Thus, for our runner whose resting heart rate is 55, the zones are:

78 + 55 = 133
94 + 55 = 149

Voila! Her target training zone for aerobic exercise is **133-149**. Now, compare that range to the simplistic method above (220 minus age x 60%-80%), which yielded zones of 108-144. The 133-149 zone is much narrower, and is tailored specifically to her own resting and maximal heart rates.

Factors affecting heart rate

Some criticize the use of a heart rate monitor as a "limiter" on training. True, if a runner tends to adhere strictly to "standardized" heart rate zones, and never makes adjustments due to other factors, then the criticism is justified. However, the improper *use* of the monitor is at fault, not the monitor itself. After all, the heart rate monitor is merely a *tool* for training, much like a running watch or GPS device.

The best use of the heart rate monitor will take into consideration a number of factors that will affect a runner's heart rate. **Cardiac drift** is common. Cardiac drift is a way of saying "your heart rate at a specific level of effort will increase as you fatigue, even at the same level of effort." This is due to dehydration, evaporative cooling, and loss of energy. So, for our runner whose aerobic zone is 133-149, we might see her start a long run at 134-135, holding a pace of 9:30 min/mile. Later, after running for 60-90 minutes, her heart rate is averaging 142-144 at the same pace. As long as she is prepared for the upwards drift, she can slow her speed accordingly, and allow her heart rate to creep upward as the run progresses.

Heat and humidity are probably the most noticeable factors on heart rate. Go for a run on a cool, dry evening, and you can hold your aerobic zone pretty comfortably. Run the same distance, at the same pace, on a hot, humid afternoon, and your heart rate might jump 8-12 beats per minute.

The point here is that you need to adapt to conditions, and also get a feel for the correct pace and level of effort that are inside your aerobic zone. A heart rate monitor, when used correctly, can help you find that zone and stay inside of it during your aerobic base training. Yes, this sometimes means adjusting your aerobic zone upwards a few beats, like our 40 year old who might adjust her aerobic zone to between 138-155 on a very hot day. The key is to be consistent and adaptable according to conditions.

"How many miles per week should I run?"

There is no one-size-fits-all answer to this question. If you are like the "New Year's resolution" runner who is just getting started, then 4-5 days per week of 30-40 minutes is a safe start. After that, building up to 30-40 miles per week is a good long-term goal.

For more experienced runners, a goal of 5-6 days per week, running 45-60 minutes each time, is a better target. One easy method is to use a two-week schedule, running 11 out of 14 days. Run 60 minutes every weekday except for one rest day each week; rest every other Sunday and run 60 minutes the other Sunday; go a bit longer on Saturdays - maybe 75-90 minutes. All totaled, at a 10-minute pace, this would be about 35-40 miles per week. As the weeks progress, take those Saturday long runs further, going 90-120 minutes at a time.

Summary - Slow Down to Speed Up!

Remember, the goal of aerobic base training is to (1) teach your body to burn fat and conserve glycogen, (2) increase your lactate threshold, and (3) increase your VO2max. The proven method to accomplish this goal is to run long and slow for a consistent and extended period of time - 8, 12 or 16 weeks, if not more. A pace that is too fast will completely miss the objectives of the base training. Likewise, a pace that is too slow will not maximize the training adaptations that are the underlying objectives of base training. One of the most useful tools for determining the proper aerobic pace is the heart rate monitor, one that is used correctly and with a thorough understanding of the principles behind heart rate training.