Basic Training Principles
for Middle and Long-Distance Running
John Davis
Preface

To the reader:

This booklet is intended to be an introductory lesson in fundamental training methods for young middle and long-distance runners. “Middle-distance” generally refers to races from 800m to 3000m in length. “Long-distance” refers to races from 3000m upwards. For high school and college runners, these distances are usually 3000m, two miles, 5000m, 8000m, and 10,000m.

Modern training methods were pioneered by Arthur Lydiard of New Zealand in the ‘50s and early ‘60s. His fairly simple program, consisting of a period of high-volume aerobic training before interval workouts and racing, set the standard for modern training methods. Popular training programs today, from “couch to 5k” plans for joggers to the best-selling Daniels’ Running Formula, are all based (if distantly) on Lydiard’s work. American training methods for the past 25 years have tended towards lower mileage and higher-intensity running year-round, instead of the relaxed, high-volume aerobic training popular during the ‘60s and ‘70s. At the same time, American athletes have become significantly slower than their African and East Asian competitors.

The facts in this preface end here. There is a good deal of debate over whether the decline in American distance running is related to the change in training methods. I strongly believe that the two are directly related; that is, that American runners are doing too much intensity and not enough mileage. Athletes are looking for a “quick fix” from hard workouts and do not have the patience to put in high-volume training. This lack of focus on aerobic training severely limits an athlete’s long-term development. It is no accident that the runners dominating international track meets and road races (the Kenyans, Ethiopians, and Japanese) have been logging prodigious amounts of quality aerobic running for years.

I believe that Arthur Lydiard’s training methods are superior to the heavily anaerobic training popular among some today, particularly for runners with less “natural talent.” Lydiard’s runners were not the prodigies of New Zealand running when they began. In 1962, a 24-year-old Peter Snell, who previously was not even the fastest half-miler at his high school, ran an 800m world record of 1:44.3 on a grass track, a time which would still be world-class today. There was no secret to his training—just long-term aerobic development, along with just the right amount of intense workouts and racing. This booklet is designed to get you on the right track for long-term development so that one day, you can “run to the top.”

—John Davis

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Cover photo courtesy JJ Vico, www.fotosjjvicoatletismo.com
Introduction

Rome, 1960. World record holder Roger Moens headlined an impressive field in the men’s 800m final at the Olympic Games. At the gun, Moens led with a fast pace, and by 600m, the lead pack had thinned to five runners. It looked to be a sure victory for the Belgian. But then, something curious happened. Peter Snell, a young New Zealander who had unexpectedly advanced through the qualifying rounds, snuck past Moens on the inside. He steadily pulled away from the field and won the gold medal.

The athletic world was shocked. How could Snell, who possessed probably the least natural speed of all of the entrants in the final, outkick the fastest half-miler in the world? He had not raced extensively on the European summer track circuit, nor had he competed at any major international meets before. Most took Snell’s victory for a fluke. However, only half an hour later, another New Zealander stole the spotlight. With three laps to go in the 5000m, Murray Halberg bolted to the front and put several meters on his competitors. Halberg ran the last lap uncontested and won the gold medal. Three days later, fellow New Zealander Barry Magee ran his way to a bronze medal in the marathon and a tired Halberg placed fifth in the 10,000m. When word got out that all three men were coached by Arthur Lydiard, a milkman and factory worker who had never been to college, the press was bewildered. The Europeans and Americans had run the most grueling workouts their university-educated coaches could devise; they did repeat after repeat on the track at dizzying speeds. How could their hard work and talent fail?

Two years later, as the New Zealanders continued to take the running world by storm, their coach Arthur Lydiard released Run to the Top, a book that outlined his training methods and set the standard for modern training.
Energy Production

Before we talk about Lydiard’s revolutionary training methods, we must first understand how the human body operates while running. The overarching principle is simple: an athlete eats food and uses it to power his or her body. Carbohydrates (sugars) are the primary fuel for a runner. Your body turns sugar into energy by breaking it down into smaller chemicals. This energy can then be used by your muscles to propel yourself forward. Sugars can be broken down by two methods: aerobic respiration and anaerobic respiration.

Aerobic Respiration

Aerobic (meaning “requiring air”) respiration is a process that breaks down sugar inside the muscles by using oxygen. After a long chain of reactions, sugar is broken down into three things: carbon dioxide, water, and energy. The carbon dioxide and water are waste products and are exhaled; this is why your breath is moist and rich in carbon dioxide. For every unit of sugar broken down by aerobic respiration, you get 38 units of energy. The only disadvantage is that oxygen (from your lungs) must be present in the bloodstream for it to happen. If oxygen is available, muscles will always use aerobic respiration.

Anaerobic Respiration

Anaerobic (meaning “not requiring air”) respiration is a process that breaks down sugar to get energy, but does not require
any oxygen. Instead of breaking it down into carbon dioxide and water, anaerobic respiration breaks sugar down into a chemical called lactate. Anaerobic respiration does not require the presence of oxygen and can produce an extremely large amount of energy very quickly. However, it only produces 2 units of energy per unit of sugar, so it is much less efficient. In addition, the lactate produced accumulates and causes extreme fatigue.\(^1\) When a sprinter “ties up” in the last 100m of the 400m dash, it is because his or her muscles are overloaded with lactate.

**Energy and Running**

When an athlete is running at an easy pace, his heart and lungs deliver the oxygen he needs to his muscles. If he begins to run faster, his heart and lungs will work harder to deliver more oxygen. As long as enough oxygen is getting to the runner’s muscles, he will not become fatigued from lactate buildup, because his muscles are working entirely through aerobic respiration. However, if this athlete begins to run very fast, his heart and lungs will be pushed to their limit and will not be able to deliver enough oxygen to produce the amount of energy his muscles require. At this point, his muscles begin to break down sugar anaerobically and lactate will accumulate. He will be able to keep up this faster pace for a while, but he will eventually become too fatigued to continue and will be forced to slow down or stop. Athletes train so they can push themselves to the very limit of lactate tolerance in a race. Races that last less than about half an hour rely heavily on the ability of the runner’s body to operate anaerobically, so training seems straightforward. If a runner trains his or her body to handle lactate buildup better, he or she will be able to run faster. However, because of the way the human body operates, this is not the whole story.

**Lydiard’s Training Method**

Arthur Lydiard experimented for years with different mixtures of fast, slow, short, and long running. He eventually discovered two very important things regarding lactate tolerance:

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\(^1\) Actually, lactate is not the real cause of muscle fatigue, but it is closely related to acidosis, the true culprit. This topic is covered in more detail in my upcoming booklet, *Modern Training.*
• Your **anaerobic capacity**, or your body’s ability to efficiently deal with lactate, can be developed to its maximum potential in four to six weeks of training.

• This maximum anaerobic capacity is limited by your **aerobic capacity**, or your body’s ability to run quickly *without* generating lactate.

Armed with these discoveries, Arthur Lydiard set out to explore the best way to develop aerobic capacity. Again, his findings can be distilled into two important (and surprising) points:

• Your aerobic capacity takes *at least* ten weeks of heavy training to develop to the point where you can handle the rigors of anaerobic training and frequent racing.

• Your aerobic capacity has *no* maximum—it can be developed and improved forever!

The limitless qualities of the body’s aerobic system are the reason that an athlete can improve year-to-year for a very long time. An athlete with a high aerobic capacity can easily run at a very fast pace for a long time without becoming fatigued. But how can a runner improve his or her aerobic capacity, and how does this lead to faster race times?

**The Conditioning Phase**

Lydiard’s training method calls for ten to twelve weeks (or more) of “marathon conditioning”: running long distances at an easy to moderate pace, day in and day out. The further you run, the more you will improve—as long as your body has the chance to recover. Lydiard’s runners tracked their mileage per week to keep track of their training. A typical schedule might look like this:

- **Monday**: training run—moderate pace
- **Tuesday**: training run—easy pace, plus strides
- **Wednesday**: fartlek at an easy pace over hills
- **Thursday**: training run—easy pace, plus strides
- **Friday**: training run—brisk, steady pace (but not anaerobic)
- **Saturday**: long run—easy pace
- **Sunday**: recovery run—easy pace

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2: A fartlek (Swedish for “speed play”) is a run at an easy pace with several short bursts of faster running. These bursts can last anywhere from 30 seconds to over 10 minutes. In a “true” fartlek, the surges are not even timed—you run fast for a while, then run slowly until you feel fresh again.
Lydiard’s runners would cover up to 100 miles per week during their conditioning phase, but only after several years of experience with lower volumes. Running too much too soon does not allow the body to recover and a runner’s performance will suffer instead of improve. “Temporary exhaustion is not dangerous, but permanent exhaustion, or fatigue, is,” writes Lydiard in the 1967 revision of Run to the Top. The key to handling high-volume training is keeping the effort on all runs relaxed and introducing blocks of higher mileage or intensity gradually. Lydiard’s favorite way to describe the conditioning phase was “train, don’t strain.”

The Saturday “long run” is the cornerstone of the conditioning phase. This run, which is around 1½ times longer than a normal training run, comprises roughly 20% of a runner’s weekly mileage. Even Peter Snell and John Davies, two of Lydiard’s best 800m runners, did weekly long runs because of the benefits. Modern exercise physiologists have confirmed that the long run makes your heart and lungs stronger, your leg muscles more powerful, and your blood vessels more efficient. Even though the long run is at an easy pace, its duration makes it fairly tiring, so it is wise (especially early in the conditioning phase) to only jog.
easily for thirty minutes or so the following day. This will allow your body to recover.

Two or three days a week (Tuesday and Thursday on this schedule), the athlete will do some relaxed “strides” on the track in his or her racing shoes. This will consist of perhaps three to six 120m repetitions somewhere between 5km and one-mile race pace, separated by a minute or so of easy jogging. These repetitions are short enough so that lactate does not build up. They help improve running form and teach the legs to remember how to feel relaxed running at a quick pace.

Often, Lydiard’s runners would do “supplemental jogging” sessions of up to an hour in the mornings. These were at a very easy, relaxed pace (sometimes slower than 8 minutes per mile—even for the world-class athletes). The morning jogs helped loosen them up for their afternoon runs and improved their aerobic fitness even more. Even moderately trained runners can benefit from short jogs a few days a week. Runs as short as 10 or 15 minutes are beneficial! The reason for the slow pace is to reduce wear on the athlete’s body, while still aerobically stimulating the heart and lungs. This practice—running twice a day—is commonly known as “doubling.”

Kenyan runners, who have dominated the international road racing scene, typically train twice a day. Just like Lydiard’s runners, their morning run is an easy jog. Photo courtesy RunKenya.com
Lydiard’s original schedules call for a four-week “hill phase” to follow the conditioning phase in order to build leg strength. During this phase, his runners would continue their high-volume training, but would incorporate uphill running, bounding, and springing exercises into their routines. Modern coaches have successfully replaced this by simply having their athletes run over hilly routes near the end of their conditioning phase and doing fast uphill repeats early in the anaerobic phase.

Though 100-mile weeks (plus the “supplemental” morning runs, which often made the total closer to 120 or 130 miles) brought Lydiard’s runners into excellent condition, such prodigious volumes can be harmful to younger runners. At the same time, however, the fastest and most successful high school athletes (as well as the ones who improve the most) are running reasonably high volumes by their senior year. Male high school standouts like German Fernandez, Rob Finnerty, Luke Puskedra, and Chris Derrick all gradually increased their mileage over their high school careers, building up to 65-75 miles a week by their senior year. Similarly, top female high school runners like Jordan Hasay, Neely Spence, and Carly Seymour built up to 45-55 miles a week, with a long run of up to 90 or 100 minutes. This mileage brought them into stellar aerobic condition and prepared them for higher mileage in college and beyond, while minimizing the dangers of injury and burnout. Mileage is a very individualized aspect of conditioning; you must find the volume and pace that is best for your age and experience. For most young runners, the answer is usually “run more!” At most levels of competition, men tend to run somewhat higher mileage than women, partially because they can run at a faster pace (and thus cover more ground in, say, an hour of running per day). As long as you are “training” and not “straining,” finishing your runs feeling what Lydiard called “pleasantly tired,” you are well on your way to aerobic fitness.
Once you have conditioned yourself with high-volume aerobic training for many weeks, you are ready to develop your anaerobic capacity.

**The Anaerobic Phase**

The anaerobic phase is the kind of training that you are likely most familiar with. The weekly training schedule shifts from daily training runs and one long run per week to *interval workouts* and recovery days. Two or three days a week are devoted to interval workouts, while the other days are easy training runs. One day every week or two is usually reserved for an easy long run to keep up your aerobic fitness.

Though you have increased your fitness through aerobic training, you still need several weeks of anaerobic training to key your fitness towards a specific race distance. A miler and a 5k
runner can do very similar conditioning phase training, but during the anaerobic phase, they will often do different workouts—but both still have the same goal: increasing their anaerobic capacity.

In its most simple form, an interval workout is made up of segments of fast running separated by anywhere from 30 seconds to several minutes of recovery, which can be spent walking or jogging. Typically, the repeats are run at a predetermined pace—usually race pace for the event you are preparing for. So, a high school runner hoping to break 10:00 in the two-mile might do 10 or 12 400m-repeats in 75 seconds each, with a minute of very easy jogging between. This workout has two goals: to stimulate the body’s anaerobic system, building up tolerance to lactate, and to familiarize the body with the pace to be run in the race. There are infinite variations of interval workouts—sometimes, you might run repetitions of different distances or speeds (“ladders”), or run up or down hills, but the overarching goals are the same—to capitalize on your aerobic fitness by developing your anaerobic capacity and to prepare your body to race. Planning out interval workouts for a season is one of the most challenging aspects of a coach’s job, and fortunately for high school and college runners, all you have to do is become aerobically fit in the weeks and months before the season begins and show up ready to work out at practice.

Interval workouts can be difficult, but you, an aerobically-conditioned runner, have many advantages. A low-mileage runner will not have the aerobic capacity to handle an entire track workout, and a runner who has already been doing hard intervals for many weeks will not gain the benefits of them anymore. You will be able to run more repeats, you will be able to run them faster, and you will require less recovery. Furthermore, your body will repair itself faster. During this phase, it is very important to remember that your improvement will come from the recovery after the workout, not during the workout itself. So, even if you work hard in every workout, if you aren’t getting enough sleep at night and enough to eat during the day, you won’t reap the benefits.
Finally, the days *between* interval workouts are designed to be “recovery runs”—most runners go somewhat shorter and slower than they do on their training runs during the conditioning phase. On these days, the intent is to lightly stimulate the aerobic system (so as not to lose your hard-won fitness) and to flush out waste generated in the workout the day before. It is also a good idea to keep doing strides on some of these easy days.

**The Championship Season**

After four to six weeks of anaerobic training, you are ready to enter the championship season. Arthur Lydiard rejected the idea that you can only perform your best on one occasion per season. After reducing mileage and leveling off the effort in workouts, Lydiard’s runners would race and improve for several weeks. They correctly realized that the time to train was over, but they could still continue to improve, simply by *recovering* after their races. The end of the season is not the time to make up for mileage by running workouts extra hard. At this point, your toughest days should be your races, and you should ensure that you are doing everything you can to recover after them. There are no magical “sharpening” workouts that will whip you into shape in a few days’ time, but if you simply focus on your next race, you will be surprised by how much you can improve even after your most difficult training has ended. When you are well-rested and mentally prepared to race, all the pieces will come together. Just like Peter Snell or Murray Halberg at the Rome Olympics, when the race enters the final stretch, your superior conditioning will allow you to pull away from your competitors.
About the Author

John Davis is a runner, writer, and “student of the sport.” He competed for Eden Prairie High School and Carleton College, where he studied chemistry, and now lives and works as a freelance writer in the Twin Cities. His blog, runningwritings.blogspot.com, provides detailed analysis of coaching philosophies, scientific treatments for injury, and insights into training and racing. He can be reached via email at johnjdiv@gmail.com.

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