ARTHUR LYDIARD on RUNNING
(transcribed, edited, and annotated by Nobuya "Nobby" Hashizume)

Arthur Lydiard is the man who knows all there is to know about running. He can make anybody in any part of the world run faster and farther with his understanding of the "what," "how," and "why" of training. After his runners' success at the 1960 Rome Olympics, where Peter Snell and Murray Halberg won gold medals within an hour of each other and Barry Magee claimed a bronze, all eyes in the running world were on this tiny shoe-maker from Auckland, New Zealand. Numerous countries invited him to set up an athletic program and coach their coaches as well as their athletes, including Mexico, Finland, Venezuela, and Denmark. During a short time in Mexico, where he received limited co-operation, his success was relatively modest, with Juan Martinez finishing 4th in both the 5,000 and 10,000 meters at 1968 Mexico City Olympic Games. His most famous overseas stay was in Finland, where his influence produced 3 gold medals and 1 bronze in 1972 Munich Olympics by Lasse Viren, Pekka Vasala, and Tapio Kantanen, as well as the next generation of "Flying Finns" who followed in the 1970s and '80s. For his effort, he was awarded the White Cross (the equivalent of Knighthood in Finland), which made him the only non-Finn to have received this honor. One of the first countries to follow Lydiard's revolutionary training method, however, was Japan, which sent a group of coaches and runners, led by the late Kiyoshi Nakamura (coach of great Toshihiko Seko), to learn from him, and invited him to Japan for a series of clinics in 1962-63. After the 1964 Tokyo Olympics, where Peter Snell collected two more gold medals and John Davies won a bronze, he went into seeming obscurity, and nobody heard the name Lydiard any more because he wasn't coaching athletes. People in Japan came to regard the Lydiard system of training as old and out of date, but in 1990, for the first time in nearly 3 decades, Lydiard was back in Japan conducting clinics in Tokyo and Osaka. Both were great successes, and many articles about him and his training method were printed in various running magazines, followed by a new book, Running With Lydiard*, which was translated into Japanese. People in the Japanese running scene were surprised to find out that the basic ideas of his training method hadn't changed much since 1960, and his influence in the running world had never stopped; he had been traveling literally all over the world through the years, conducting clinics in the United States, Italy, Germany, China, Ireland, India, Australia, and Kenya. His latest book,* Running to the Top*, was published in 1995 in Germany, then translated into English and made available in the USA. Moreover, we would later find out that behind Korea's outstanding performance in the 1992 (gold medal) and 1996 (silver medal) Olympic marathons, there was Lydiard, who had visited them beforehand and later sent his disciples, Barry Magee and Jack Ralston, to lay the groundwork for Korea's emergence in this event. It may only be coincidence that Lydiard's return to Japan preceded a set of great performances by Japanese marathon runners, but it certainly didn't hurt!*

Here, then, is a transcript of the lecture Arthur Lydiard presented in April of 1990 in Osaka, Japan.

I'm one of those people who realize that there are great champions everywhere: every village, every town, every country, and I put my neck out before the 1988 Seoul Olympics when I said I thought the Japanese would win the Olympic marathon. I still think one of the Japanese marathon runners should have won the Olympics because they could run fast enough to do it, but the trouble is that they didn't run their fastest on the day of the race [1]. That was their problem.

I'm always telling young athletes, "Suppose you look back at last season and there is one day when everything went right and you ran your best time of the year. If you know why you ran so well that day and you can put your training together so as to produce your top form the day of the Olympics or the Japanese Championship or whatever big race you are pointing for, then you know something about training, but until you can do that, you don't know anything about training. You are just a good athlete who one day might run a good race, but you don't know when, so there's a need for better evaluation and understanding of each aspect of training, as well as how to put them together in a balanced way."

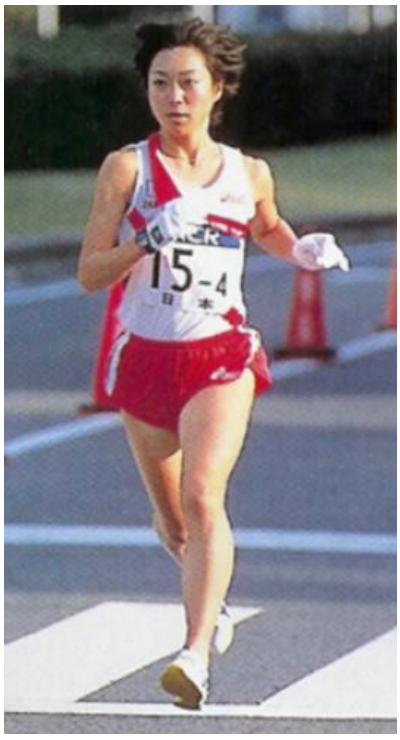
* * * * *

Training Balance

There are three basic aspects of physical preparation to be considered: (1) the ***aerobic*** development, (2) the ***anaerobic*** development, and (3) the development of sprinting ***speed***, which we wish to increase by improving technique and strength. These development periods are sequential, i.e., one follows the other, and the training has to be systematic. It doesn't matter what exercise we get involved in, whether it's cycling or lifting weights or swimming or running, we can do too much or too little of any one aspect, we can do it too fast or not fast enough, we can do it at the right time or the wrong time – this is basically what training is about. For instance, there has to be a good understanding of anaerobic training, when to fit it into the program, and when to back off it. Athletes who know how to control anaerobic training can control the ultimate form and peak on the desired day. Always, you must adhere to such physiological and mechanical fundamentals; if you get away from them, you'll create an imbalance in your training.

In working with young athletes, I try to explain my approach, and the need for the correct training balance. It's no good training athletes if you only teach them what to do and how to do it, you must also teach them *why* they are doing it. Every day's training should be explained in terms of the physiological and mechanical effect it is intended to achieve. Athletes who understand this are better motivated and produce the best results.

In Japan, you've done very well in conditioning athletes with marathon-type training, but in many ways, this is overly emphasized. Mr. Hirose, the host of this clinic, who gave a speech at the beginning, is right when he says that Japanese runners have become obsessed with marathon training, and haven't considered other aspects of training deeply enough. If we are going to produce good runners, we have to understand it is possible to overdo marathon training, which can result in too much muscular viscosity. Usually, when I go to a country, I have to encourage people to do more of this training, but in Japan, I think maybe you should have another look at the amount you are doing.



A female Japanese runner. Note the excessive outward arm swing and pivoting of the torso.

Now, we all should know that the aim in training is to develop sufficient endurance to maintain necessary speed over the selected distance. In other words, to run 3:43 for 1,500-meters, it's only 60 seconds for each 400 meters, which many of us can do separately, but which few of us can maintain continuously for nearly four laps. It is true that performance level is governed by aerobic threshold, and our anaerobic development is a limited factor in human beings, but from my observations of Japanese runners, I think in many cases they do a little too much of the marathon conditioning, and are wrongly evaluating anaerobic repetition or interval-type training, probably doing too much of it in the period of aerobic volume, canceling out some of the good condition that they've developed through marathon training, and losing control of the ultimate peak form.

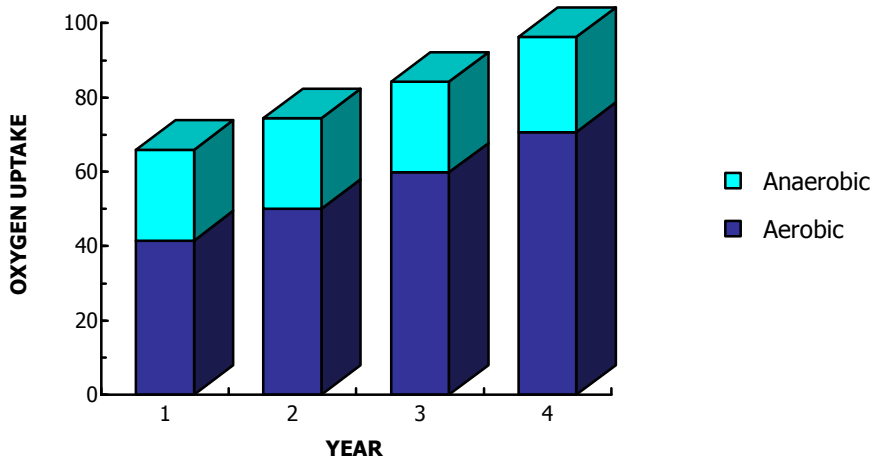
In addition, I don't think speed and technique are being worked on sufficiently; there has to be concentration on developing it throughout the whole year (I'm talking about sprinting speed, not from anaerobic development) [2]. I watched the young women in a race, a half marathon, a couple of days ago, and I hardly saw one who has been taught to run properly. All were running tight around the shoulders, throwing their arms around. This type of flawed technique leads to wasted effort and loss of forward momentum. You must learn to relax, which is a key to good running, and this fundamental has been overlooked.

Aerobic Development

If we look at the development of the oxygen uptake level, we understand that, in some cases, there are people who can go out and run 145 kilometers (90 miles) today, tomorrow, the next day, and the day after that. They have acquired this ability through development of their cardiovascular system, particularly the capillaries, to get quick recovery. We have a man in New Zealand, Max Telford, who actually ran 384 km (240 miles) without stopping, and he can run a marathon in 2:30 something. He can't go any faster than that, but he can turn around and go back in the same time, so he has sacrificed his speed to a large extent. This is why years ago when I ran 400 km (250 miles) a week, testing out theories, I found it's too much, but when we ran about 160 km (100 miles) a week in our main training sessions, and jogged six mornings a week up to an hour, we got the best results [3]. If we did more than that, we started to tighten up.

Even my middle distance runners, like Peter Snell and John Davies, did the same mileage as my long distance runners. Why? Well, what do both middle and long distance runners require? They need high oxygen uptake level as the governing factor in their performance level, they need anaerobic development, and they need speed. This is why I trained them all the same, except in the last ten weeks, when we decided which event they were best suited for, and then changed the training to co-ordinate their efforts for that particular event. I got the man like Snell in a tireless state, where he could run and run and run and not get tired, so when he got to the last half-lap of the 800 and 1,500 meters, he wasn't the least bit tired, and could use his sprinting speed.

In laying out my approach to training, the first element to explain is oxygen uptake level as a governing factor of performance level, and the limitation of anaerobic development. This can be shown in a simple way with the following chart, where energy expenditure is represented as oxygen uptake, in milliliters per kilogram per minute, on the vertical axis:



We know that the ability of the top endurance athletes to assimilate, transport, and use oxygen has an upper limit, called of VO_2max, of about 7 liters per minute, or 85-90 milliliters per kilogram per minute. Now, if we have a high school athlete with a VO_2max of 3 liters/minute, I try to explain to them that this is not yet a limiting factor, and it can be improved; no one knows what the limits are to the development of the cardiovascular system in any individual. Years ago, they used to say that it was limited, but today, we know it is not. We do not know the limit.

What we do know is that, as a human being, our ability to incur oxygen debt, called anaerobic capacity, is limited to between 15 and 20 liters [4], so if I give this athlete with a VO_2max of 3-liter/minute some anaerobic training, and in the 4 weeks it typically takes to develop this to its maximum, let's say we reach an anaerobic capacity of 18 liters. We have now the reached performance limit of the athlete, because it's physiologically impossible to increase this anaerobic capacity any further.

Now suppose this athlete carries out a workload that requires 4 liters of oxygen per minute. He is incurring an oxygen debt of 1 liter/minute (4 liters/minute required − 3 liters/minute capacity), and can keep going for only 18 minutes at that speed (18 liters total oxygen debt ÷ 1 liter debt each minute). If we increase the workload to 5 liters/minute, he will incur an oxygen debt of 2 liters/minute (5 liters/minute required − 3 liters/minute capacity), and can only keep going for 9 minutes at that speed (18 liters debt ÷ 2 liters debt each minute), therefore, oxygen debts not only double, but square and cube, and as we get faster, the oxygen debt becomes very, very great with the small increases in speed, eventually causing neuromuscular breakdown, or failure.

The only way to improve this athlete's performance limit is to increase the base (aerobic capacity). If it can be raised be from, say, 40 ml/kg/min in the first year, to 50 ml/kg/minute in the second year, and so on (see chart), I can improve the performance level with the same anaerobic capacity, so the performance level is governed by aerobic threshold, not by anaerobic development, and this can be improved year by year with what I call marathon training, or the aerobic volume of training.

This is why I try to explain to my athletes, "You don't make yourself great doing anaerobic training; you make yourself great doing aerobic training." You also have to understand when to back away from anaerobic training. You can do too much of it.

With regard to marathon training, we found that prescribing workouts by time rather than mileage gives better results, particularly when developing young people. For instance, if we say we are all going out for 25 km (15 miles), some people might require an hour-and-a-half, while those who aren't quite as fit and don't have the background of training might take two hours, and end up doing too much training on the basis of time; the important aspect is that each should run the same duration in relation to their fitness level and training background.

It is also important, when developing young people prior to their fast growth spurt, to understand that their ability to use oxygen in comparison to their body weight is greater than adults, so they are better equipped to run long distances than adults. If we look at the Africans – the Kenyans, Tanzanians, and Ethiopians – who are now beating most people in the world, it's not because they have scientific laboratories to train and test them, but simply that they do a lot of running; they run to school, they run home, they run everywhere. So we have to encourage our young people to do a lot of running, aerobic running, but not to race too much, because at that age, they have highly sensitive nervous systems and can't stand a lot of anaerobic training or pressure.

Then we have to get them to look at their natural ability and basic speed. In your country, like mine, we are not very fast, not like the African Americans, and therefore we are too slow in most cases to compete internationally at 100 and 200 meters, but because our fastest sprinters can be the national 100-meter champion, even though their rank might be well down in the world listing, they prefer to run the 100-meters, instead of switching to the 800-meters where their basic speed would probably allow them to be of international caliber. We've got to make our good athletes think internationally, not nationally.

You can't make a slow person fast, but you can maximize what speed they do have, so I put my athletes through years of training to improve this area as much as we can. I use 200 meters to decide what event a they might be best suited for, because the start can influence the result too much in the 100 meters, while endurance plays too big a role over 400 meters, so 200 meters gives a good indication of basic speed.

For instance, if you have a man who can run 22 seconds or better for 200 meters, he is fast enough today to become an international-caliber 800-meter runner, but if he is slower than that, there is little prospect of him progressing that far, and he must train for a longer distance, such as 1,500 meters or more. If you lack the speed, you lose the economy of running action, trying to maintain the pace.

Anaerobic Development

From a physiological point of view, the purpose of this period is to build up body's buffering mechanisms against lactic acid by carrying out a workload that requires more oxygen than our body can provide. The net result is pyruvic acid, the excess of which is converted to lactic acid, and with a heavy workload of anaerobic training, about 48 hours are required to recover between workouts, or even more in some cases. If we carry out the training properly, we'll pull down the pH level of blood as low as possible with a big volume of anaerobic work one day, and then do it again two days later with the same workload, or a similar workload. In other words, it pays to pull the pH level of blood as low as possible, then allow it to get back to normal again before you pull it down again.

If you get an athlete who races his training, that is to say, trains with people who are too fast for him, he does too much anaerobic work, and will maintain a lower than normal blood pH level for long periods of time. If you were to test his blood, you would find that the platelets would be very low, recovery becomes slow because of the effects on some of the enzyme functions, and the immune system can be affected adversely. In fact, if you look at the training schedules of athletes who are continually getting breakdowns, muscle pulls and other injuries, coughs and colds, and are otherwise unhealthy, you will almost invariably find an excess of anaerobic workouts [5]. Staleness is a tell-tale sign as well; when athletes become edgy and nervous, can't eat well, and can't sleep well, it's a psychological response to a physiological condition resulting from excess anaerobic training and chronically lower-than-normal blood pH level, which in turn adversely affects the central nervous system, so when we use anaerobic training, we must be very, very careful, and understand what we are doing. It's better to under-do anaerobic training than over-do it, but most people do the latter.

You also have to remember that the day you start doing anaerobic training and stop your (aerobic) conditioning, your basic performance level has been determined for the season [6], and once you start with anaerobic training, you have to keep doing it, so if you start it too early in the season, you will get an imbalance by sustaining it.

It is also important to realize that no one in the world can determine exactly how much anaerobic training an individual should do. You can't train to hypothetical figures, and too often I see coaches take their athletes down the track and they'll say, for the sake of argument, "I want you to run 400 meters 15 times in 65 seconds, with such-and-such of a recovery interval," without the athletes having any say in how many they should do. They usually give their athletes a round figure like 10 or 15 or 20 repetitions. Now if the athlete goes to the coach and asks, "Why am I doing fifteen 400-meter reps? Why not 12 or 13 or 17?," the coach wouldn't be able to tell him. He just wrote down 15. So if the athlete gets to 12 reps and has had enough, he must still do three more. Why? Only because the coach wrote down 15.

One of the reasons why Americans don't produce very many good middle and long distance runners, with millions of people running there, is simply because of this factor: coaches determining, with hypothetical figures, exactly what athletes should do in anaerobic training. As a coach, you may be able to judge pretty closely what your athlete can do, you may be right in saying he can do fifteen repetitions of 400 meters in 65 seconds with so much recovery, but the main thing is to explain to the athlete not only what to do and how to do it, but why he is doing it, what physiological adaptations he is trying to bring about with the training. When he hits the wall, he's had enough, and he should determine when to stop, not the coach. The key to training is to regulate each workout according to your individual reactions to it.

When we are going to train an athlete to develop the anaerobic capacity to maximum, we have to understand exactly what we are trying to do. To bring about the low pH level of the arterial blood, we have to do a high volume of anaerobic training.

By contrast, if I put an athlete out on the track and say, "I want you to go around that track five times, and every 100 meters I want you to sprint 50 meters as hard as you can," he sprints full-out for 50 meters, then floats 50, sprints 50, floats 50, etc. In 400 meters he sprints 4 times, and in 5 times around the track, he

sprints 20 times [7]. The athlete will probably be out there for about 8 or 9 minutes, and by then, his legs will be getting very, very tired; he will be starting to get neuromuscular breakdown, and the muscles will no longer contract. Now if we sample blood from the leg muscles, and draw blood from the ear lobe for arterial blood, we will observe two different readings: there will be very low pH in the leg muscles, but this will not be true of arterial blood. It's just like getting down and doing 50 push-ups. Upon finishing, my arms will be tired. I'm not tired overall from doing it, but the muscles no longer contract [8].

To be effective in developing anaerobic capacity, however, we must use longer intervals, and if the same athlete goes out and runs 800 meters six times while jogging 800 meters in between each repetition, he's running at a lower anaerobic intensity, but is incurring an oxygen debt, which in turn will create lactic acid and start to lower blood pH; he'll be out there for a half an hour or more, but his legs won't be getting tired as quickly, and he won't be getting as tired generally, because each effort is not as intense as a 100 meter sprint, and there is longer recovery coming back.

In this case, if we then take the blood from the ear lobe, we will find a lower pH level, which is what we are trying to achieve. Thus, there must be a sufficiently large volume of anaerobic training in order for it to be effective, and it can't be too fast, i.e., at top speed with many short intervals [9].

Through trial and error, we have found that hard anaerobic training should take place three days a week, for a period of three-and-a-half to four weeks, in order to develop anaerobic capacity to near maximum. When you get near the end of four weeks hard anaerobic training, you have a dilemma: continue on with it, and you'll pull your condition down, but if you under-do or stop doing it, you'll lose some development. So at this point, we'll go on to do what we call "sharpeners" once a week where we sprint 100 meters in every 200 meters, or 50 meters in every 100, like we talked about a moment ago, and this in turn – because it's short and sharp – helps to maintain anaerobic development without pulling the condition down. This is why the co-ordination training phase includes development races and sharpeners, since we have found this further develops anaerobic capacity, if it wasn't already to its maximum.

In any schedule I've written, I've emphasized that the workout details are hypothetical figures, purely for guidance, and I always explain to the athletes that they shouldn't strictly adhere to those figures, just use them as a guide in relation to how they feel. I think too many coaches are too dogmatic, and they are determined to make their athletes do things as they've written, instead of taking their athletes' responses into consideration. I think most athletes know when they have had enough of excessively heavy overload of anaerobic work, and it's very important to understand to back away from that as quickly as possible when you start to get that adverse effect.

Co-ordination of Training

In a moment, we'll begin our discussion of speed development, but first let's talk about co-ordination of training. When we go into track racing, or any racing for that matter, we have to accustom our body to what we expect it to do on the day of the competition. In other words, if we are going to run at a certain speed over certain distances, you have to get your body used to that [10], so what I usually do at the start of this period is to get an athlete to run that distance, or nearly the distance, at near racing speed, on his own, with no watch, no calling out lap times. From the overall time as well as lap times, I'll get an indication of where that athlete is at that stage of training. We then begin the co-ordination period, which is the last six weeks of a 10-week track training period, and you know something, it's very easy to sharpen an athlete and bring to them to racing pitch, provided they are well-conditioned [11].

So from those early days when you give them the faster work, then proceed to the sharpeners, and finally to under-distance and over-distance development races and time trials, the time will come down very, very quickly. You want to increase the tempo of the work in the last six weeks gradually; you don't want your athlete to go out and see how fast he can run in those first weeks, rather, you want to gradually put more pressure on him week by week [12].

Let's say we are working with a 5 km runner, and he does 5 km in 15 minutes for his first trial, without the watch, and no competition. About 3 days later, we'll send him out for another 5 km trial, but this time we'll give him split times for each lap, and we'll have him run a little faster than 15 minutes. We'll have him increase the tempo progressively each week, gradually getting him to run faster [13]. As I've said before, it's very easy to sharpen the well-conditioned body.

Based on the fluctuations and responses of the athlete, we can determine what training to use at this time. For instance, if you had a young runner who came in after his 5,000-meter run and said, "I don't know, coach. I'm not tired but I couldn't go any faster," you know he is not sharp enough. He needs under-distance races or fast trials. On the other hand, if you get an athlete who goes very fast early and starts to slow down at the end, you know he needs some over-distance fast runs. All athletes are different in their responses, so you have to be a little experimental in the later stages of training to determine exactly how to co-ordinate the training, but the trials tell you very much.

Just to explain this co-ordination a bit further . . . I trained Murray Halberg this way in 1960 in the 5,000 meters, and he ran strongly and evenly over 5,000 meters near racing speed. In those days, the athletes he ran against were all interval-trained, so they went out and ran fast, had a rest, ran fast, and had a rest, so when they got in the race, they were looking for the rest periods, whereas Halberg was able to run strongly all the way. I told him that the pace would slacken with about three laps to go, and the others would try to have a rest, but when this happened, he didn't need any pause, and put in a 60-second 400 meters. He got 80 meters on the field in one lap, simply because they'd been trained to have a rest and he hadn't. That got him the gold medal. People said to me afterward they couldn't understand how, in the Olympic final in front of 80,000 people, the rest of the field could only watch and do nothing about it as Halberg ran away. It was simply because they'd been trained incorrectly.

We must realize that the races we run in this six-week period are purely for the development of co-ordination and to prepare the athlete for the big races coming, for the main event. Athletes should never race seriously until they are properly prepared for it [14], and once they begin, the hard training is finished. All the effort then goes into racing, and the training is very light [15]. You can't train hard and race well at the same time, so when you continue coaching the athletes into their competition period, remember two words: you've got to keep them ***fresh*** and ***sharp***. If this 'race-maintenance' training is aerobic, it should not be too long in duration, and if it's anaerobic, it should be neither too long nor too demanding; it has to be short and sharp.

When I had Snell in Tokyo in 1964, we jogged an hour very easily in the morning. He raced 6 races in 7 days. He won two gold medals, and the last day when he won the 1,500 meters, it was very easy for him, like a training run, and he won by 40 meters. He said afterwards he didn't have to run hard. When we went to the track in the day time, we'd see the athletes he'd run against still training hard.

You can hold your form once you are fit, provided you are sure to allow recovery from very hard races. How long you can hold it is also related to how broad your conditioning base is.

Speed Development

Finally, we address speed, which is very important, and not emphasized enough by the Japanese runners from what I've seen in the last few days. Most middle and long distance runners do a lot of conditioning and anaerobic repetition work. They think the latter, such as running 200 meters or 400 meters, develops speed [16]. In the actual fact, it *counteracts* speed. When you see people doing a lot of repetitions, they invariably start to tighten their shoulders and the neck muscles, simply because their quadriceps are getting tired. Once that happens, you can't lift your legs, and you start to tighten the shoulders.

We must understand that relaxation is the key to good running form. If you watch Florence Griffith-Joyner winning the 100 and 200 meters at the Seoul Olympics, you see she was completely relaxed in her upper body while running at top speed. She was actually smiling, and her jaw was loose. When Carlos

Lopes and Carl Lewis won the two most disparate running events at the 1984 Olympics (the marathon and 100 meters), they shared exactly the same running qualities between them, except that Lewis brings up his knees higher and his arm action is much more exaggerated. They are both upright, their arm action is nice and loose, coming through inside their shoulders, and with their hips under the torso. If you get your hips back, you can't get your knees up, and you lose stride length and stride frequency.

Fundamentally, you increase speed either with longer strides, or faster strides, or a combination of both. When my upper leg is horizontal to the ground, I'm going to get optimum stride length, whereas if my knee goes down, my stride shortens. When I bring my knees up, my foot comes up higher, and if you observe Carl Lewis, when he sprints, his heel is right up on his butt. Now, we know from mechanics that a short lever moves faster than a long lever, and if I give any of you a 3-meter rod to move fast, you can't move it as fast as a short stick, so a stride coming through like kicking a football is a slow stride, whereas a stride coming through with the foot high is a fast stride. Of course, you are not going to run a marathon with high knees, but by exaggerating things and through drills, you start to get the correct running action.

You should run like you walk, and when you walk, you are upright, and your arms swing nice and loose, coming through inside your shoulders. Now if you clench your fists and tighten your shoulders, or bring your arms up and tighten your shoulders, something has to go back; either your hands will, or your shoulders will. I saw all the Japanese girls running the other day like this, wasting effort. When you throw your shoulders, you are throwing kilos over here and kilos over there, and you are actually going along in a zigzag trajectory instead of as straight a line as possible. When we do sprint drills, anyone who throws arms around, they'll fall over.

When I start to train athletes, the first thing I teach them is to run relaxed. When we go for long runs, we learn to run relaxed. Always relax, relax, relax, teach them to relax. The arms must come through straight, just touching the side of running shorts. The reason cross country skiing is better for cardiac development than even running is that you are using a lot of energy in the upper body with the sticks, but with running, the less you bring the upper body into play, the better. The more relaxed you are, the better.

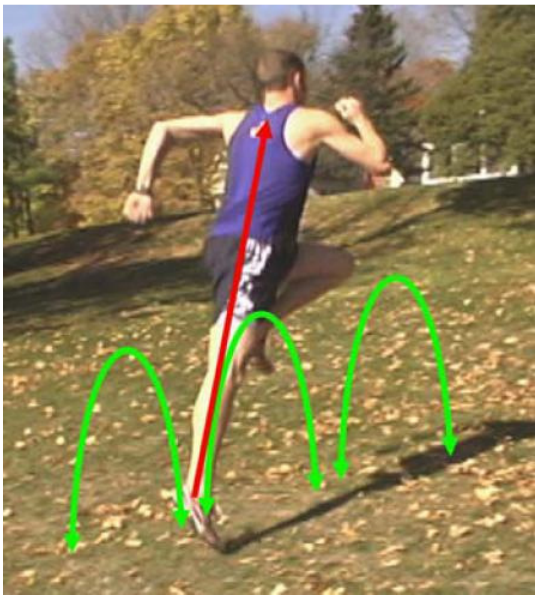
I see people lifting weights and adding muscle mass in the upper body. I ask them why they are doing it, and they say that they have to be strong and move their arms faster. When I train athletes, I try to make their legs go faster, not their arms. No one can move the legs as fast as their arms anyway; your arms should always co-ordinate with and counterbalance your leg action.

If you put more muscle on the upper body, you will run more slowly. For every kilogram you have in fat-free body mass, it requires 0.17 milliliters of oxygen to run each meter, so if you are a road runner and you come to a hill, and you have excess weight on your legs, you will either burn up more energy going up that hill to maintain a given speed, or else go up it more slowly. The same thing will be true for the steeplechaser who must lift that extra weight over the barriers. Lasse Viren, with whom I worked in Finland, looked like a plucked chicken when he took his shirt off. There was no muscle there at all, just ribs sticking out. He won four Olympic gold medals.

Hill Training

In some writing I've done, you'll see photos of people lifting weights. The reason I did that is I have lived in other countries, like in Denmark around Esburg, where it is dead flat – there are no hills whatsoever, no sand dunes, and no stadium – so in such a case, it's wise to use weights [17], but apart from that, if there are hills, it's much better to leave the weights alone.

The reason we use hill training for our speed conditioning or muscular conditioning is because, in New Zealand, no one pays us to train, and we all go to work everyday. If we start lifting weights, we still have to do our running and our stretching. When we train on hills, our body weight provides sufficient resistance, helping us stretch and lengthen the stride, so we are able to accomplish several things at once. There is no more rewarding way than training on hills. You'll get very good results from it.



Hill springing up a steep incline for powerful, flexible ankles

We do three things on hills. We've got to be strong in the upper thighs. There are very few runners in the world who can maintain their knee lift right throughout their race. Their knees start to go down near the end. I'm talking only about necessary knee lift, you don't run a race like that (with high knees) all the way, just necessary knee lift.

So not only do we need capillary development for muscular endurance, we also need muscle fiber development, or in other words, power. By running up steep hills or stairs, we strengthen an entire area. We don't sprint up the hills; we are not trying to make it a hard anaerobic workout. We go up at the speed sufficient to maintain our forward momentum, while putting effort or stress on the legs, or in other words, to bring resistance to the legs. The slower we go up the hills, the more resistance we'll get on the muscles. You must bring your knees up, and to do that, you must have your hips forward, and you've got to drive off the back leg.

We also do a lot of bounding up a long steady slope. I saw a lot of runners here with their knees bent all the time. They never straighten their legs. Mifuyu [a runner/writer who escorted Lydiard in Japan] tried hill bounding yesterday, and already has sore legs at the back because she's been running with her knees bent. It's when you straighten your leg that you get the power; if your legs are bent all the time, you get no power, so by bounding up a hill, taking long bounding strides, bringing the knees up, driving hard off the back leg on a gentle slope, you start to get a lot more power and a better running action. Pekka Vasala, whom I helped in Finland, and who won the 1,500 meters in Munich Olympics, did lots of hill bounding. He loved to do hill bounding on a 200-meter hill. It showed very graphically in the final of the 1,500 meters when he came down on the straightaway; there is a picture of him, and you could put a board from his heel right through to his head. It was dead straight line, and he was getting the maximum drive as he came down the straight. That helped him to win the gold medal.

Pekka Vasala (left) and Kip Keino in the final stretch of the 1972 Olympic 1,500 meters.

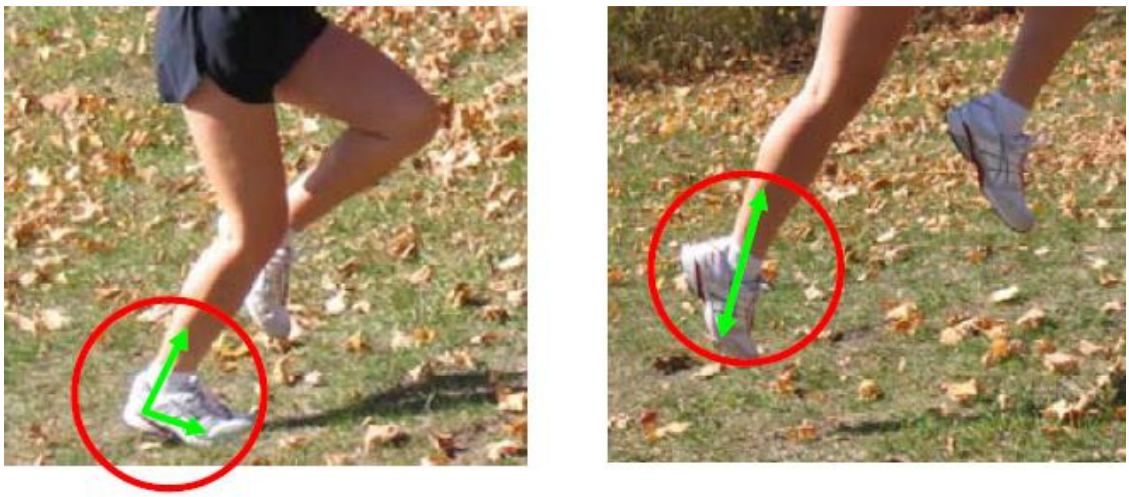
I'm always trying to impress on the athletes that probably the most important development we can get is of the ankles – flexible, powerful ankles. We don't want our runners like weight lifters or gymnasts, we want them like ballet dancers. You know how they spring and bounce around with flexible, powerful ankles. If we can make our runners like that, then we'll have speed. Both Murray Halberg and Lasse Viren had the same running action, which came from their ankles and allowed them to accelerate very quickly. So what we do is to get on a gentle slope and use our body weight for resistance by elevating it as high as possible with slow forward momentum, coming down on the ball of each alternate foot. Being on a hill, this gives us an extreme ankle extension both going up and down, extending muscles and sinews in the front and back of the legs, and strengthening all the muscles around the tendons, eliminating the possibility of tendonitis. I've never ever had an athlete with Achilles tendon or hamstring troubles, because training on hills gives you a nice balance of resistance in muscle groups.

Hill bounding – "Like a deer going over a fence."

Like any other training, you must prepare yourself to do a lot of hill training. When we are doing marathon conditioning training as a main session of our training, we go out jogging as a supplementary workout, and during that secondary jog, we will do a little hill training, not much, just a little, just to activate the muscles in the legs.

Then when we finish the aerobic conditioning period, we usually concentrate on hill training for about four weeks, at least three days a week. We'll do anything from 15 minutes up to an hour on the hills. We'll go into it gently in case some people will pull their legs around too much.

Beforehand, we warm up for about 15 minutes by running to the hill, we stretch, and then we'll work on a hill for a given period of time. We don't say we'll go up the hill specific number of times, rather, we say we're going to be there for a given time, in which we do what we feel our legs will allow. Each athlete concentrates on what he thinks he needs more than any other exercise. If he feels he is weak in ankles, he'll concentrate more on that, etc., but we will mix in all the exercises.



Detail of ankle action during hill springing

When we get up the hill, we'll jog around to let our legs to recover sufficiently, then we come down, striding out fast and relaxed, unless the hill is too steep to allow this. In striding down the hill, because your lead leg is hitting the ground later that would on the flat, it means you've got to pull your trail leg through faster, which, in turn, helps you to gain leg-speed. I taught the East Germans in 1965 to do a lot of leg-speed running on gentle slope and their sprinters use it even today.

So we try to do this for about four weeks, three days a week, up to an hour a night if we can. Then, during the second part of the anaerobic phase, we concentrate on heavy anaerobic work for about four weeks, which we balance with technique running, basically with four exercises. Now there are lots of sprint drills people can do, but we do just these four, since we find them effective in achieving fast action in the upper legs and making the upper thighs strong. The first is *high knees*, where we try to overcome muscular viscosity and get the arms coming straight through. To get power and drive, we do something

Stride-out exercise.

on the flat that is like *bounding* on the hill, while *stride-outs* [18] help bring the correct leg action; first we walk through them, then we skip through them. Once we can handle it, we do the striding out properly, then we try to get the athletes to *run tall*, to keep the posture up tall.

Until we get the athletes running correctly and efficiently, we'll concentrate technique once or twice a week. We go down the track, and after warming up, we'll do each exercise twice over 100 meters, then we try to combine all four. We'll get the athletes to think two things: ***keeping tall*** and ***high knees***. Always with the wind from behind if possible [19], we pick up the speed 50 meters before the straight and then run down the straightaway as fast as we can, relaxed, keeping up tall and high knees. Then jog 250 meters nice and easily, and repeat it six or ten times. Once you get your athletes running with good technique in this latter stage, always try to get them to do one session a week of ten reps, keeping tall just exactly as at the end, picking up the speed, down the straightaway with the wind, working on leg-speed and technique.

Now if we can improve our athletes in this aspect, it means they can hold their early speed much more easily, and they can conserve their energy because they are running economically and mechanically correct, getting more power and drive, or in other words, striding longer without being conscious of it, which will aid the finishing kick. A lot of runners do lots of long, long running, but they can't capitalize on their good condition because they don't have the speed to do it.

When we have gone through all this, I make all my runners compete in sprint races at a club level, even in the handicap sprints. Distance runners hate sprinting because they think they look like fools, but if you want to be fast, you've got to sprint. Through speed development, I've taken three and six minutes off the times of two marathon runners I coached [20], so it is important to runners at all distances on the road and on the track. In fact, runners should be doing something about their speed, conditioning for it, working on technique, and generally developing their speed every week, 52 weeks a year.

Arthur Lydiard
Osaka, Japan
April, 1990

Endnotes, by Nobby Hashizume

1. Lydiard was referring to Toshiheko Seko, who won the Boston (twice) and London Marathons prior to the 1988 Seoul Olympics, where he finished ninth; and to Takayuki Nakayama, who had run 2:08 on three occasions before finishing fourth in Seoul.

2. As far as Lydiard was concerned, sprinting speed, or pure speed, is different from anaerobic speed, which is developed by intervals or repetitions.

3. These morning jogs are at an easy effort.

4. According to exercise physiologist Peter Snell, Ph.D., the absolute oxygen debt limit is more near to 4.0 liters. If 4.3 liters of oxygen per minute are required for a 70 kg runner to cover 5,000 meters in 16 minutes, then a runner with a VO_2max of 3.5 liters/minute would be able to run at this pace for only 5 minutes (4 liters ÷ 0.8 liters/minute = 5 minutes), but if he can raise his VO_2max to 4.05 (16%), he would incur 0.25 liters of oxygen debt per minute, and would be able to run 5,000 m in 16 minutes (4 liters ÷ 0.25 liters/minute = 16 minutes).

5. Most metabolic reactions, if not all, occur in an alkaline condition. With an excessively low blood pH level, enzyme activities are adversely affected.

6. This does not mean you will not further improve your times, in fact, the coordination and sharpening/ freshen-up periods are where they will really start to come down, however, because the basic performance level is determined by aerobic (not anaerobic) capacity, once you stop working on the former, the range in which you will perform for the season is set.

7. These are called "sharpeners," and they have a very important role in during the coordination phase for the maintenance of anaerobic capacity and without pulling the good condition down.

8. Here Lydiard is referring to muscle groups involved in the particular activity being performed – in this case, the legs. When the effort is kept short and sharp with a truncated recovery (only a quick float), lactic acid builds up quickly in the working muscles, whereas with the greater volume of work from intervals or repetitions, lactic acid build-up in the legs will not be as rapid and as localized, but will circulate throughout the body and bring down the overall blood pH.

9. If the work intervals are performed too fast and/or the recovery interval is too short, the workout may have to be terminated prematurely.

10. The concept behind Lydiard's use of the time trial is that it is important to prepare your body for *continuous* effort; without them, sharpeners and repetitions will "teach" your body to "expect" a recovery period during the actual competition.

11. If you have followed the Lydiard program with plenty of aerobic conditioning at the beginning and strict control over anaerobic and speed development, your body should respond well and be 'sharpened' quickly. On the other hand, if you lack a good aerobic base, the time trials at high effort may cause you to "go over the edge."

12. Times should come down naturally in response to the sharpening and coordination period, you should not try to squeeze or force the improvements out to get faster.

13. This is the classic example of the "date pace-goal pace" concept. You can draw a line from the first trial to your target goal time to determine how much faster you should run with each trial, and ideally, the progression should be linear.

14. “You don’t eat a cake half-cooked” was what Lydiard frequently said. Everything is important – aerobic conditioning, anaerobic capacity, speed, coordination/sharpening, and tapering. You cannot test your true racing form until you develop all these. Additionally, you are still training hard at this point and therefore should not expect to race well.

15. Many high school runners and coaches tend to continue hard training even once racing has started, not taking into consideration that racing is the hardest form of exercise anaerobically. To continue training hard with a high volume of repetitions/intervals (e.g., 15-20 × 400 meters), or long aerobic runs at a high intensity is to invite staleness or illness.

16. The purpose of repetitions is to develop anaerobic capacity. They allow you to run faster because they increase lactate tolerance, but the resultant lactic acid accumulation adversely affects running mechanics, hence the need to correct this by balancing repetitions with pure speed development workouts, which are performed in a relaxed fashion, with correct running mechanics.

17. Hill training is a form of resistance exercise and can be performed with weights or in the gym as plyometrics, with boxes.

18. This is not simply running faster, as is often interpreted, rather, it is a specific exercise intended to teach you to bring your knees high, carry your feet high, and bring your feet forward out front. Lydiard called it “striding-out,” and it involves a lot of coordination, therefore it is recommended that you first walk through the movement, then skip through it before actually running through it.

19. This should not be performed with any resistance, such as a headwind or parachute; you need to run relaxed, and these conditions invariably cause you to tighten up, thereby defeating the very purpose of technique work. A tailwind or slight downhill also helps develop leg-speed.

20. Lydiard took over the training of New Zealand’s Terry Manners for the 1974 Commonwealth Games marathon. Manners was known as mega-mileage runner, but Lydiard cut back his training volume and worked on his speed with drills and shorter races. He cut his marathon time from 2:15 to 2:12 and won the bronze medal.

How to set up a training schedule

1. Counting back from the first important race date:

    a. allow 7-10 days for Freshen-up

    b. allow 5 weeks for Co-ordination Training } Track Training

    c. allow 4 weeks for Anaerobic Development

    d. allow 4 weeks for Hill Resistance Training

    e. remaining time is for Marathon Training, at least 10-12 weeks

2. Marathon Conditioning Period (10-12 weeks or as long as possible):

    a. starts with only aerobic running (flat and hills)

    b. later includes a day of easy fartlek and strong runs over 5 and 10 km

3. Hill Resistance Period (4 weeks):

    a. hill training 2-3 days a week

    b. 1 long aerobic run per week

    c. other days for leg-speed or easy running

4. Track Training Period (9 weeks):

    a. Anaerobic Development Training (first 4 weeks):

        1) anaerobic training (i.e., repetitions, fartlek, etc.) 2-3 days weekly

        2) 1 long aerobic run weekly

        3) other days for sprint training or easy running

    b. Co-ordination Training Period (last 4½ to 5 weeks):

        1) sharpeners

        2) development races (under- and over-distances)

        3) fast relaxed runs

    c. Freshen-up: 7-10 days

5. Continuation of racing (Race Week/Non-Race Week).


Competition
Taper
10-14 days
Coordination
4 weeks
Anaerobic Capacity Training
interval training/speed development
3-4 weeks
Hill resistance/leg speed
4 weeks
Aerobic Conditioning ("base" or "foundation")
10-12 weeks or longer

On-line resources:

Lydiard's Wikipedia entry – http://en.wikipedia.org/wiki/Arthur_Lydiard

Lydiard's page at the Athletics New Zealand Hall of Fame –
http://www.athletics.org.nz/Article.aspx?Id=1536

"Arthur Lydiard, Running Man" – http://www.nzedge.com/heroes/lydiard-arthur.html

Obituary and tributes from *The New Zealand Herald* –
http://www.nzherald.co.nz/section/4/story.cfm?c_id=4&objectid=9003093
http://www.nzherald.co.nz/section/4/story.cfm?c_id=4&objectid=9002987

Obituary from *The New York Times* –
http://www.nytimes.com/2004/12/13/sports/othersports/13lydiard.html

Obituary from *The Times* (London) –
http://www.timesonline.co.uk/tol/comment/obituaries/article1077892.ece

Obituary from *The Age* (Melbourne) – http://www.theage.com.au/news/Sport/Lydiard-leaves-timeless-legacy/2004/12/13/1102787015546.html

Obituary from the IAAF web site – http://www.iaaf.org/news/Kind=131072/newsId=28022.html

Lydiard Foundation – http://lydiardfoundation.org

Lydiard hill training slide show – http://lydiardfoundation.org/training/drilltraining.aspx

Lydiard shoe lacing method slide show –
http://lydiardfoundation.org/training/lacingthelydiardway.aspx

Video clip of Lydiard hill bounding and springing techniques –
http://lydiardfoundation.org/training/hilltrainingdvd.aspx

"Legendary Lydiard," by Nobuya Hashizume – http://www.runningtimes.com/rt/articles/?id=5232

Lydiard's 1999 presentation in Des Moines, Iowa (PDF, 1.3 MB) –
http://rundynamics2.webs.com/lydiardiowa99.pdf

Discussion of Lydiard method between Nobby Hashizume and John Molvar –
http://www.bunnhill.com/BobHodge/Special/LydiardInterpreted.htm or
http://www.bunnhill.com/BobHodge/Special/LydiardResponses.htm

"Q & A with the God of Jog," by Mike Prizy –
http://www.chicagoaa.com/features/speedplaylydiard03.html

"An interview with Arthur Lydiard," by Roland Rust –
http://www.runwashington.com/features/trainlydiard05.html

"Where have all the runners gone?," by Brian Taylor (PDF, 9 MB) –
http://lydiardfoundation.org/pdfs/WHATRG.pdf

"The world according to Lydiard"– http://lydiardfoundation.org/pdfs/WATL.pdf