

ARTHUR LYDIARD'S LECTURE

(dictated, edited and footnotes added by Nobuya "Nobby" Hashizume)

Arthur Lydiard is the man who knows everything there is to know about running. He can make anybody in any part of the world run faster and farther with his understanding of "what," "how," and "why" of training. After his runners' success in 1960 at Rome Olympics where Peter Snell and Murray Halberg won a gold medal with Barry Magee's bronze medal, all the eyes in the running world were on this tiny shoe-maker from Auckland, New Zealand, who coached all these three young men. Many countries came to invite him to coach their coaches as well as athletes and set up an athletic program. He would eventually go to Mexico, Finland, Venezuela, and Denmark as their national coach. He had relatively moderate success in Mexico, in a short period of time with limited co-operation, when Juan Martinez finished 4th in both 5,000 and 10,000 meters at Mexico City Olympic Games in 1968. However, his most famous overseas stay was in Finland where his influence produced 3 gold medals and 1 bronze in 1972 Munich Olympics with Lasse Viren, Pekka Vasala, and Tapio Kantanen; and a set of next generation of "Flying Finns" that followed in the 70s and 80s. For his effort, he was awarded the White Cross, the equivalent of Knighthood in Finland. He is the only non-Finnish to have received this honor. One of the first countries to follow Lydiard's revolutionary training method, however, was the host country of 1964 Olympic Games, Japan. Japan would send a group of coaches and runners, led by the late Kiyoshi Nakamura (coach of great Toshihiko Seko), as well as inviting Lydiard to Japan for a series of clinics in 1962~63. After he went into seemingly obscurity after Tokyo Olympics where Peter Snell collected two more gold medals and John Davies won a bronze medal, nobody heard the name Lydiard any more because he wasn't coaching athletes. People in Japan regarded the Lydiard training as old and out of date. However, in 1990, for the first time in nearly 3 decades, Lydiard was back in Japan conducting clinics in Tokyo and Osaka. It was a great success and many articles about him and his training were printed in various running magazines, followed by publishing of his new book, "Running With Lydiard" translated in Japanese. People in the Japanese running scene were astounded to find out that basic ideas of his training method hasn't changed much since 1960s and, more so, the fact that his influence in the running world had never stopped all this time. He was traveling literally all over the world, conducting clinic all these years. Besides USA, he had been in Italy, Germany, China, Ireland, India, Australia, as well as Kenya as recently as 1992. His latest book "Running to the Top" was published in 1995 in Germany, now translated back in English and available in the USA. Moreover, we would later find out that, behind Korea's golden performance in 1992 (gold medal) and 1996 (silver medal) Olympic marathon, there was Lydiard who in fact visited them before 1988 Seoul Olympics and later sent his disciples, Barry Magee and Jack Ralston, to set up the groundwork for Korea's emergence as one of the leading marathon nations. I would not lightly point out that Lydiard's re-visit to Japan was responsible for a set of great performances by Japanese marathon runners in recent years. But it certainly hadn't hurt! This is the script of the seminar Arthur Lydiard conducted 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 Korean Olympics (Seoul Olympic Games in 1988), I stated that I thought the Japanese would win the Olympic marathon¹⁾. 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. That was their problem.

¹⁾ Lydiard was referring to Takayuki Nakayama who had run three 2:08 marathons prior to the Olympics and eventually finished 4th in 1988 Seoul Olympic marathon; and Toshihiko Seko who had won Boston marathon twice and London marathon prior to the Olympics and eventually finished 9th in 1988.

Basic Principles of Training

I'm always telling young athletes; "If you look back last year at your performances and one day you went out, the previous year, you ran your best time of the year; everything went right. If you knew WHY you ran so well that day and this year you can put your training together, so on the day of the Japanese Championships or the Olympics or the big race you are training for, you can produce your top form; 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, would run a good race but you don't know when.

So there's a need for better evaluation of each day's training and better understanding of training and putting them together in a balanced way.



Seko (l) and Nakayama (r) after 1988 Seoul Olympic marathon: *T&F Magazine*, Japan

There are three basic practices we have to consider; (1) the aerobic development, (2) the anaerobic development, and (3) the development of speed as a sprinter. One development period follows another, and the training has to be systematic.

Always you must adhere to physiological and mechanical fundamentals. If you get away from these fundamentals, you'd be getting imbalance in training. There has to be a good control and understanding of anaerobic training; when to fit it into the program, and when to back off it. Athletes who understand how to control anaerobic training can control the ultimate form and peak on the day.



A Japanese female runner; note her arm swinging out and tensing up shoulders

In Japan, you've done very well in conditioning of the athletes with the marathon type training, but in many ways this is overcentuated. 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 exercise, we can do it too fast or not fast enough, we can do it on the right time or the wrong time. This is basically what training is about.

Mr. Hirose (the host of this clinic who gave a speech at the beginning of the seminar) is right when he says that Japanese runners have become obsessed with marathon training; haven't considered deeply enough other aspects of training. 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 running tight around the shoulders, throwing arms around. You must learn to relax. Relaxation is the key to good running.

This type of (false) technique will lead to wasted effort and loss of forward momentum. Fundamental has been overlooked.

If we are going to produce good runners, we have to understand that, by doing all this marathon training, we can overdo it. We can develop too much muscular viscosity.

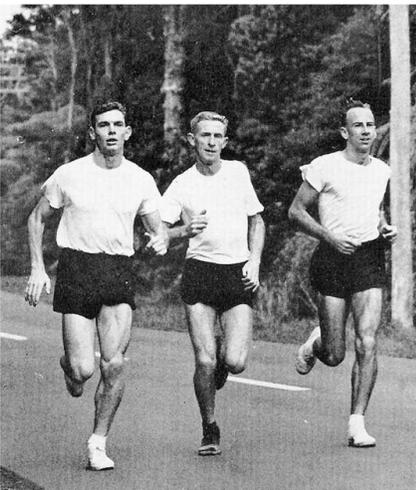
Usually, when I go to a country, I have to encourage people to do more of this training. In Japan, I think maybe you should have another look at the amount of this type of training you are doing and compromise of it.

Now we all should know that the aim in training is to develop sufficient endurance to maintain necessary speed over the distance. In other words; to run a 3'43" 1,500-meters, it's only 60 seconds for 400 meters. But most of them can't maintain 60 seconds for nearly four laps to run a 3'43". Also we should understand that our performance level is governed by aerobic threshold, and our anaerobic development is a limited factor in human being.

So I think, in many cases in my observations in Japan, or observing the Japanese runners, that you do a little too much of the marathon conditioning; you are wrongly evaluating anaerobic repetition or interval type of training, probably doing too much of this in the volume, and canceling out some of the good condition that you've developed, and losing control of the ultimate top peak form. Also speed is not being developed sufficiently. There has to be concentration throughout the whole year on the development of speed. I'm not talking about anaerobic speed, I'm talking about sprinting speed¹⁾.

Aerobic Capacity

If we look at the development of the oxygen uptake level, we can understand that, in some cases, there are people who can go out and run 140 kilometers (=90 miles) today, tomorrow, and the next day and the next day. They continue doing this. They



Snell (800m), Halberg (5000m) and Magee (marathon) all trained together over a 22-mile Waitatarua course on Sunday: photo courtesy of Garth Gilmour Collection

have the ability through their development of blood vascular system and their capillaries to get quick recovery. We have a man in New Zealand called Max Telford, who actually ran 240 miles (=384 km) without stopping. And he can go out and run a marathon in 2:30 something. He can't go any faster but he can turn around and go back in the same time. He sacrificed his speed to a large extent. This is why years ago when I ran 250 miles (=400 km) a week, testing out theories, I found it's too much. This is why I found that we ran about 160 kilometers (=100 miles) a week in our main training sessions and jogged in the morning, six mornings a week up to an hour²⁾, that we got the best results. If we did more than that, we found we started to tighten up.

Even my middle distance runners like (Peter) Snell and (John) Davies also did the same mileage. Because what does the middle distance runner and distance runner require? They require the

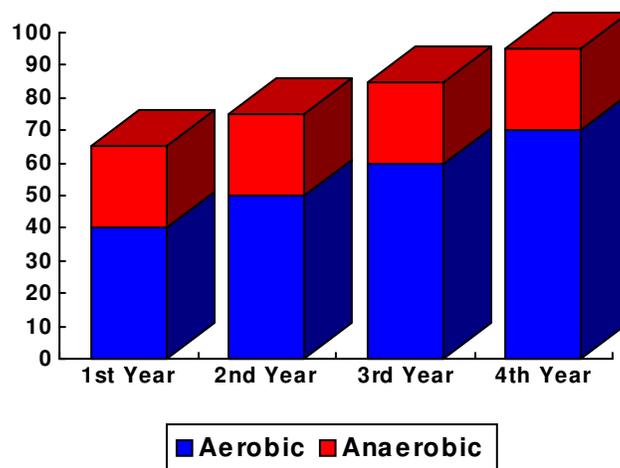
¹⁾ As far as Lydiard was concerned, sprinting speed, or pure speed, is different from anaerobic speed developed by doing intervals or repetitions.

²⁾ These morning jogs are recovery jog at easier effort.

high oxygen uptake level as the governing factor in their performance level. They need speed and they need anaerobic development. So this is why I trained them all the same, except in the last ten weeks when we decided which event they were better suited for and changed the training to co-ordinate their efforts for that particular event. So 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 the last 200 meters of the 800 meters or 1,500 meters, he wasn't least tired, and he can use his speed and sprint.

I tried to explain to young athletes what their approach should be, and the need to get a 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 to them physiological and mechanical reactions they are trying to achieve in each training. Athletes who know not only what to do and how to do it, but why they are doing it, are better motivated and produce the best results.

I think we should first explain my approach to training when we talk about the need to get the high oxygen uptake level as a governing factor of our performance level, and the limitation of anaerobic development, we can probably explain in a simple way with the following chart. This is how I explain to my athletes in a simple way the approach they have to make in training:



Just for the argument sake, this (vertical axis) is the oxygen in liters per minute (milliliters per kilogram per minute). We all know that great endurance athletes, their ability to assimilate, transport, and use oxygen is an excess of 7 liters per minute, or 85 milliliters per kilogram per minute. We know that. So if we have a high school athlete with oxygen uptake level of, say, 3 liters per minute, I try to explain to them that this (aerobic development = blue) is not a limiting factor, that this can be improved. No one knows what the limits are to the development of the cardiac system in any individual, no one knows this. Years ago, they used to say this was limited. Today we know that it's unlimited. We don't know its limits

But what we know is that, as a human being, our ability to incur oxygen debt is limited between 15 and 20 liters. This is just a very simple ways to explain to young people. So if I give this athlete with a 3-liter uptake level sessions of anaerobic training to

perform; which takes about 4 weeks to develop to its maximum; and we develop anaerobic capacity of, say, just for an argument sake, 18 liters (anaerobic capacity = red) in between 15 and 20, so we now have developed this athlete's anaerobic capacity, this is now the performance level of the athlete (total = blue + red), because it's physiologically impossible to increase this anaerobic capacity any greater, any further.

So if I explain to the athlete that he carries out workload that requires 4 liters of oxygen per minute, he is incurring an oxygen debt of 1 liter per minute (4 liters/min. required – 3 liters/min. capacity), he can only keep going for 18 minutes at that speed (18 liters total oxygen debt ÷ 1 liter debt each minute). And if we increase the workload to 5 liters per minute, he is incurring an oxygen debt of 2 liters per minute (5 liters/min. required – 3 liters/min. capacity), he can only keep going for 9 minutes at that speed (18 liters debt ÷ 2 liters debt each minute)¹⁾. So we know that the oxygen debts not only double, but square and cube. So as we get faster, with the small increase in speed, the oxygen debt becomes very very great, eventually causing neuromuscular breakdown.

Now in this particular case with this athlete of the oxygen uptake level of 3 liters, this is now the performance level. The athlete can do all the anaerobic training he likes but, once maximum is achieved, it's physiologically impossible to improve the performance level by trying to elevate anaerobic capacity to exercise. So the only way we are going to get this performance level up is to get the base (=aerobic capacity) up. So if I can bring that base up to here (from, say, 40ml/kg/min. in the first year to 50ml/kg/min. in the second year and so on in the chart), I can improve the performance level with the same anaerobic development (on the top of the oxygen uptake level: see the chart). So the performance level is governed by aerobic threshold, not by anaerobic development, and the aerobic threshold can be improved year by year with the marathon type training, with the aerobic volume of training.

So 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 the anaerobic training. You can do too much of it (to affect physiological condition adversely).

Just talking about aerobic development, we found that if we work on the time basis rather than mileage basis, we got better results, particularly developing young people. For instance, if we say we are all going out for 25 kilometers (=15 miles), some people might finish a half an hour before the others and people who aren't quite as fit and haven't got the background of training, therefore those people start to do too much training on the time basis. In other words; some people would only take an hour and a half to run 25 kilometers (=15 miles) in training, others might take 2 hours. The important aspect is that they run an hour and a half in relation to the fitness level and the background of training.

¹⁾ Lydiard used these figures to explain the nature of oxygen debt in a very simply form. However, in the recent study, it is now believed that the limit of oxygen debt in human being is more like 4~5 liters. Dr. Peter Snell, one of the leading experts in exercise physiology who trained under Lydiard, explained this in a more up-to-date formula. Please refer to footnote (3) of chapter 2 in "Arthur Lydiard's Athletic Training".

It's also important, when you are developing young people, before they go through the fast growth rate, to understand that their ability to use oxygen in comparison to their body weight is greater than adults. Therefore, they are better equipped to run long distances than adults are. 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 on, but simply because they do a lot of running; they run to school, they run home. So we have to encourage our young people to do a lot of running, aerobic running, and not to race too much. Because at that age, they have highly sensitive nervous system and they can't stand a lot of anaerobic training or pressure.

Then we have to get them to look at their natural ability and the basic speed. In your country like my country, we are not very fast, not like the African Americans, and therefore we are too slow for the 100 meters and the 200 meters in most cases. But because our fastest people can be the 100-meter champion of Japan but maybe in the world listing would be way back in the 100ths, he prefers to run the 100 meters to be the national champion, instead of looking at himself as an 800-meter runner which, with basic speed, would probably allow him to be a good international runner. We've got to make our good athletes think internationally, not nationally.



Future Olympians competing barefoot in Kenya: photo courtesy of Tony Tanser

I put my athletes through years of training and trying to find out and we get our speed down as best as we can, in other words; you can't make a slow person fast, but you can improve their speed. I used 200 meters to decide what event the particular runner is best suited for. I use 200 meters because in 100 meters their sprint start can play a big part, and in 400 meters endurance plays too big a part. And in 200 meters we can get a good indication of the athlete's 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 be an international great 800-meter runner. But if he is slower than that, there is little prospect that he will be a great international 800-meter runner. So he must look for the longer distance, like 1,500 meters or more. If you lack the speed, you lose the economy of running action, trying to maintain the pace.

Anaerobic Capacity

Let's talk about anaerobic development and understanding of it. If we understand the simple physiology of it (anaerobic development); that is to carry out the workload that requires more oxygen than our body can assimilate, transport and use. Of course we all know that the net-result of this is pyruvic acid and lactic acid; and with the heavy workload (of anaerobic training), it requires about 48 hours to recover, 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 accumulation of lactic acid in the blood stream) with a big volume of anaerobic work one day and then plan, two days later, to carry out the

workload again, or similar workload. In other words; in anaerobic training, it pays to pull the pH level of blood as low as possible, allow to get it back to normal again before you pull it down again.

If you get an athlete who races his training, in other words, trains with people who are too fast for him, who does too much anaerobic work, and maintains the lower than normal pH level of blood for long periods of time, you'll find that if you took the blood test, the blood platelets of this athlete would be very low; recovery becomes slow because of the effects on some of the enzyme functions; the immune system can be affected adversely. In other words; the athletes who are continually getting breakdowns, muscle pulls, and other injuries; who are continually getting coughs and colds and unhealthy, if you look at their schedules, invariably you'll find the excess of anaerobic workouts¹⁾.

And also staleness; when the athletes become edgy and nervous, can't eat well, can't sleep well, it's psychological reaction to the physiological reaction of brought about to doing excess of anaerobic training and maintain lower than normal pH level of the blood, which in turn affects central nervous system adversely. So when we are using anaerobic training, we must be very very careful and understand what we are doing. And it's better to under-do anaerobic training than over-do it. Most people over-do it.

Also you have to remember that the day you start doing anaerobic training, you've got to keep doing it. So if you start doing it too early in the season, you are going to get the imbalance in training (by keep doing anaerobic training) and you are trying to develop the ability above what the human being can stand. Also the day you start doing anaerobic training and stop your (aerobic) conditioning, your performance level has been determined (for that season)²⁾.

You've got to also realize that there is no one in the world who can determine exactly what anyone should do in anaerobic training. You can't train to the hypothetical figures. Too often I see coaches take their athletes down the track, for the argument sake, they'll say, "I want you to run 15 times 400 meters in, say, 65 seconds with such-and-such of an interval," without the athletes having any say in how many they should do. The coaches usually set their athletes a round figure like 10 or 15 or 20 repetitions. Now if the athletes went to the coach and said, "Coach, why do I have to do 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 the athlete would get to, say, 12, and he's had enough; he is going to have to do three more. Why? Because the coach wrote down (a hypothetical number of) 15.

One of the reasons why Americans don't produce very many good middle distance and distance runners, with millions of people there running, is simply because of this

¹⁾ Most of metabolic actions and reactions, if not all, are performed in the alkaline condition. With excess lowering of blood pH level, enzyme activities will be affected adversely.

²⁾ This does NOT mean that you are not going to improve your times for the season any more. In fact, with all the sharpening and coordination training, this is where your times would start to come down. However, because your performance level is governed by your aerobic capacity, not your anaerobic capacity, once you stop working on development of aerobic capacity, that will be the level of your performance for the season.

factor; coaches determining with the hypothetical figures exactly what athletes should do in anaerobic training. Well, as a coach, you may be able to determine pretty closely what your athlete can do. You may be right in saying he can do fifteen 400 meters in 65 seconds with such-and-such interval. But the main thing is to explain to the athlete not only how to do and what to do, but why he is doing it. What physiological reactions he is to bring about with the training. And when he finishes, 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 train to your individual reactions to the training.



Snell and Baillie performing track workouts; photo courtesy of Garth Gilmour Collection

Now when we are going to train the athlete, and train him 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 lot of (volume of) anaerobic training.

So 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," every 100-meters, he sprints full-out 50 meters; sprint, float, sprint, float. So in 400 meters he sprints 4 times; around the track 5 times, he sprints 20 times. The athlete will probably be out there for about 8 or 9 minutes¹⁾. By then his legs will be getting very very tired and start to get neuromuscular breakdown; muscles no longer contract. Now if we bring that athlete in, and took the blood from the leg muscles, and took the blood from the ear lobe for

arterial blood, we are getting two different readings. We are going to get a very low pH reading in the leg muscles, but it's not going to be very low in the arterial blood. Just like; if I get down and do 50 push-ups, after 50 push-ups my arms get tired. I'm not tired doing it, but muscles no longer contract²⁾. So if we are going to get an effective reaction, we have to do longer training.

So if I say to the same athlete, I want you to go out and run 800 meters several times, like six times, run one, jog one, run one, jog one; he's running at a lower anaerobic effort, but he's incurring an oxygen debt, which in turn will create lactic acid and start to lower the pH level of blood, but legs won't be getting so tired quickly, muscles won't be getting so tired generally; because you are getting recovery, because you are not trying at such a fast effort and you are getting longer recovery coming back. So if that athlete runs down six times 800 meters fast and six slow, he'd be out there for a half an hour or more. If we bring him in then, and take the blood from the ear lobe, we will find we got lower pH level of the blood which is what we are trying to achieve.

¹⁾ This is called "Sharpeners" and has a very important roll during coordination phase for maintenance of anaerobic capacity without pulling good condition down.

²⁾ Lydiard is referring to the muscle groups that are involved in that particular activity; in this case, legs. Because of short, sharp sprints with premature recovery (only a quick float), lactic acid would build up very quickly in the working muscle groups; whereas with the volume of anaerobic exercise such as intervals or repetitions, lactic acid build-up in the legs will not be as quick, but it will be circulated around the body generally and bring down the overall blood pH throughout the body.

So if we are going to do anaerobic training, we have to do a big volume of it to be effective, and it can't be very very fast; can't be at the top speed with all those short intervals¹⁾.

So through trial and error, we found that if we did hard anaerobic training three days a week for a period of three-and-a-half to four weeks, we'd develop our anaerobic capacity to exercise to near maximum. Because the training that follows in the co-ordination training, brought in development races, another short sharp anaerobic work; we found, as we continue training in the co-ordination phase, that we are doing development racing and another short sharp anaerobic work, which in turn will further develop anaerobic capacity, if it wasn't to its maximum.

So when you get to the near the end of four weeks of hard anaerobic training, if you do it this way, you have a dilemma: If you continue on hard anaerobic work, you'll pull your condition down. If you under-do it or stop doing it, you'll lose that development. So then we'll go on to do, once a week, what we call "sharpeners". We'll sprint 100 meters in every 200 meters or we sprint 50 meters in every 100 meters like we talked about before. And this, in turn, because it's short and sharp, helps to maintain anaerobic development without pulling the condition down. I think most athletes know when they 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.

In any schedule I've written, I've written hypothetical figures, but they are purely for guidance and I always explain to the athletes that they shouldn't strictly adhere to those figures. Just use them as guidance and go by their own reactions. 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 into consideration the athletes' reactions.

Now we are going to talk about speed development, but let's just talk about co-ordination of training first.

Co-ordination

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 that²⁾.

So what I do; I usually get an athlete to run over the distance or nearly the distance, at the start of the six-week period, at near racing speed, on his own, with no watch, no timing (not calling out lap times), and from the overall time and by taking lap times down, I'll get the indication of where we are exactly with that athlete at that stage of

¹⁾ If the intervals/repetitions were performed too fast or with premature recovery, then you may have to finish the workout prematurely to achieve the overall lowering of pH throughout the body generally.

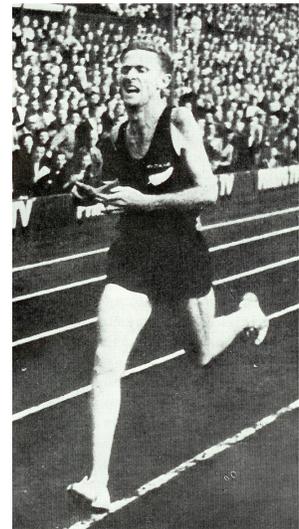
²⁾ It is important to accustom your body for a continuous effort. The concept behind Lydiard's time trial is that, by sharpening with repetitions alone, your body will expect "recovery period" during the actual competitions as well.

training; now we are going into the six weeks co-ordination period which is the last six weeks of a 10-week track training period. And you know one thing; it's very easy to sharpen the well-conditioned body to bring into the racing pitch, it's very easy to do this if they are well-conditioned¹⁾.

So from those early days when you give them the faster work; sharpeners, and under-distance and over-distance development races and trials, very very quickly the time will come down. So you try to gradually increase the tempo of the work in the last six weeks. You don't want your athlete to go out and see how fast he can run in those first (few) weeks but gradually putting more pressure on him week by week²⁾. So after that first trial or run that we give him, say, for instance that he is a 5-kilometer runner, and he goes out and runs his first trial in, say, 15 minutes for 5k, without the watch, and no competition, we know where we are exactly with that athlete at that stage. So about 3 days later, we'll send him out for another 5k and now this time we'll give him lap times, every time he goes by we'll call him lap times, and we'll have him run a little faster than he was when he ran 15 minutes. So progressively each week we'll have him increase the tempo, gradually getting the athlete to run faster³⁾. Bearing in mind what I've told you before, it's very easy to sharpen the well-conditioned body.

Depending upon the fluctuation and the reactions of the athlete, we can determine what training to use in conjunction with this (time trials). In other words; you may have to give him under-distance fast runs or over-distance fast runs. 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. You are going to have to give him under-distance races or fast trials. Or if you get an athlete who goes very fast early and starts to die at the end, starts to slow down at the end, you know you have to give him some over-distance fast runs. Now all athletes are different in their reactions, so you'd 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; when I trained Murray Halberg in 1960 in the 5,000 meters, he was training this way. So he ran strongly and evenly over 5,000 meters near racing speed. In those days, the athletes he ran against were all interval trained. In other words; they went out



Murray Halberg winning 5000m at Rome Olympics in 1960: photo courtesy of Garth Gilmour Collection

¹⁾ If you have followed the Lydiard program with lots of base-building aerobic training in the beginning of the program with strict control over speed and anaerobic development, your body will react very well and get sharpened very quickly. On the other hand, if you lack good aerobic base, with all these time trials at good effort, it will go "over the edge" quickly.

²⁾ With all the quicker workouts, times should come down naturally; not to be forced to get faster. You should not try to squeeze the time out too quickly by trying to run these trials faster.

³⁾ This is the classic example of "Date Pace-Goal Pace" concept. You can draw a line from the first trial to your target goal time; with how many weeks, or how many trials, left in mind; you can determine exactly how much faster you should be running each trial. Ideally your progression from trial to trial should follow that line.

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. So I told him, about three laps to go, that the pace would slacken, that these people were trying to have a rest. And whereas they were having a rest, he didn't need it 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. And, of course, that got him win the gold medal. People said to me afterward they couldn't understand in the Olympic final in front of 80,000 people how the rest of the field could just watch Halberg run away and not do anything about it, simply because they'd been trained incorrectly.

Racing Begins

In this six-week period, we'd better realize that it's purely for development of coordination and races we run at this period are purely to develop the athlete for the big races coming, for the main event. Athletes should never race seriously until they are properly prepared for racing¹⁾. When they start racing, the hard training is finished. All the effort now goes into the racing and the training is very light²⁾. You can't train hard and race well at the same time. If you get to keep the athletes, remember two words; you've got to keep them FRESH and SHARP. If you do it in aerobic nature, it's not too long (and too fast); and if you do anaerobic training, it shouldn't be too long a duration, shouldn't be too demanding; it has to be short and sharp.

I think, by doing this, when I had Snell in Tokyo in 1964, we jogged an hour in the morning very easily. 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, it was like a training run, he won by 40 meters. He said afterwards he didn't have to run hard. When we used to go to the track during the daytime and see the athletes he'd run against still training hard.

You can hold your form once you are fit. You can hold your top form for a long time, providing you make sure that you allow the recovery from very hard races. This is also in relation to your conditioning base.



Peter Snell winning his third gold medal in 1500m at Tokyo Olympics in 1964: photo courtesy of Garth Gilmour Collection

Speed Development

Now we are going to talk about speed, which is very important; and not emphasized enough by the Japanese runners from what I've observed in the last few days. Most

¹⁾ "You should not eat a cake half cooked" was what Lydiard always said. Everything is important—aerobic development, anaerobic development and speed. You cannot test your true racing form until you develop all these. Also you are still training hard at this point and should not expect to race well.

²⁾ Many young athletes or high school runners/coaches tend to continue hard training even all the racing had started, not taking into a consideration that racing is the hardest form of exercise anaerobically. To continue to train hard with volume of intervals/repetitions such as 15~20×400m or long runs at hard effort while racing hard can be fatal.

middle distance and distance runners do a lot of conditioning; they do a lot of anaerobic repetition work. They think anaerobic repetition work, like running 200 meters or 400 meters, develops speed¹⁾. In the actual fact, it counteracts speed. When you see people doing a lot of repetitions, invariably they start to tighten their shoulders and the neck muscles, simply because their quadriceps are getting tired. And once your quadriceps got tired, you can't lift your legs, and you start to tighten the shoulders.

So we have to understand that, in running, relaxation is the key to good running. If you saw a movie of Flo Jo winning 200 meters and 100 meters at Seoul Olympics, you saw her running at top speed and she was completely relaxed in her upper body, she was actually smiling, her jaw was loose. If you get a movie of (Carlos) Lopes winning the marathon at Los Angeles and Carl Lewis winning the 100 meters, you are going to see exactly the same running actions, except that Lewis brings up his knees higher



Carlos Lopes of Portugal (shown here in the 10000m in 1976 Montreal):
photo courtesy of "Track & Field Monthly" from Japan

and his arm action is much more exaggerated. They are both upright, their arm action nice and loose, arms coming through inside their shoulders nice and loose, with their hips under the torso. If you get your hips back, you can't get your knees up, so you lose your stride length and stride speed.

You get speed fundamentally two ways; with longer strides and faster strides. So when my upper leg is horizontal to the ground, I'm going to get the optimum strides. If my knee goes down, my stride shortens. Of course, if I bring my knees up, my foot comes up higher. Carl Lewis, when he sprints, his heel is right up on his butt. So we know, in mechanics, a short lever moves faster than a long lever. So if I give any of you a 3-meter rod to move fast, you can't. If I give you a short stick, you can move it fast. So a stride coming through like kicking a football (with your knee almost straight) is a slow stride. A stride coming through with a foot high (right underneath your buttock), it's a fast stride. Now we know you are not going to run a marathon with high knees, but by exaggerating things and drilling, you start to get the correct running action.

When you run, you should run like you walk. When you walk, you are upright and your arms swing nice and loose and coming through inside your shoulders (without elbows sticking out laterally). Now if you clinch your fists and tighten your shoulders, or bring your arms up and tighten your shoulders, something has to go back; either your hands will go back or your shoulders will go back. I saw all the Japanese girls

¹⁾ These repetitions are a workout to develop anaerobic capacity. They will make you run faster because of faster mechanics involved and lactate tolerance but the nature of these workouts (with accumulation of lactic acid) would invariably tense up the running action. Pure speed development workouts should be performed relaxed to teach your body correct running action.

running the other day like this, wasting effort. When you throw your shoulders, you are throwing kilos over there and kilos over there. And actually you are going along like this (zigzag) instead of straight. When we do sprint drills like you see Helen (Lydiard's assistant who accompanied him to Japan) doing (high knee, striding and bounding exercises, etc.), anyone who throws arms around, they'll fall over.

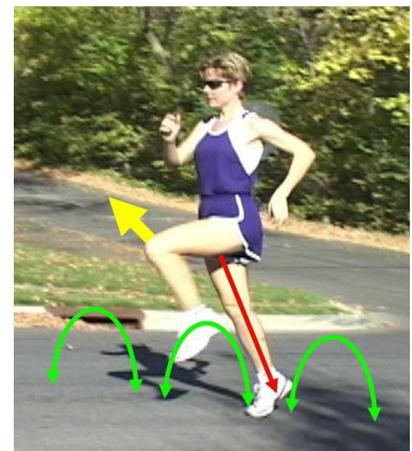
When I start to train athletes, the first thing I teach them is to run relaxed. When we go for long runs, we learn to run relaxed. Always relax, relax, relax, teach them to relax. The arms must come through straight, just touching the side of running shorts. The reason why cross country skiing is better for cardiac development than even running is because you are using a lot of energy in the upper body with the sticks. The less you bring the upper body into running, the better (because you don't use up as much energy when you don't get your upper body involved). The more relaxed you are, the better.

I see people lifting weights, trying to get more muscles in the upper body, you ask them why they are doing it, 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 they can move the arms. Your arms always coordinate with your leg action. If you put more muscles on the upper body, you are going to run slower. For every kilogram you have in fat-free body weight, it requires 0.17 milliliters of oxygen to run every meter.

So if you are a road runner and you come to a hill, and you got more kilos in your knees, you are going to go up that hill slower, you are going to burn up more energy. If you are a steeplechaser and you have to lift that extra weight over those fences, you are going to run slower. You are wasting energy with those extra kilos. Lasse Viren, who I worked with in Finland, when he took his shirt off, he looked like a plucked chicken. There is 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 because, I've lived in other countries, like in Denmark around Esbjerg where it is dead flat, there is no hills what-so-ever, no sand dunes, and there is no stadium. So when you are living in a flat area, and you don't have any possibility to work on hills, it's wise to use weights¹⁾. But apart from that, if there are hills, it's much better to leave the weights alone.



Steep Hill Running with high knee action

The reason we use hill training for our speed conditioning or muscular conditioning is because, in New Zealand, we all go to work everyday, no one pays us to train. If we start lifting weights, we still have to do our running, we still have to do our stretching.

¹⁾ Hill training is a form of resistance exercise and can be performed with weights or some plyometric exercises in the gym like jumping over boxes.

So by working on hills, we are able to use our body weight for resistance which is sufficient; and also working on hills stretches and helps in lengthening stride length; and consequently we are able to combine the whole thing at once. There is no more rewarding way than training on hills. You'll get very good results from it.

We do three things on hills. We've got to be strong in this area (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 about necessary knee lift, you don't run a race like that (with high knees) all the way; necessary knee lift.

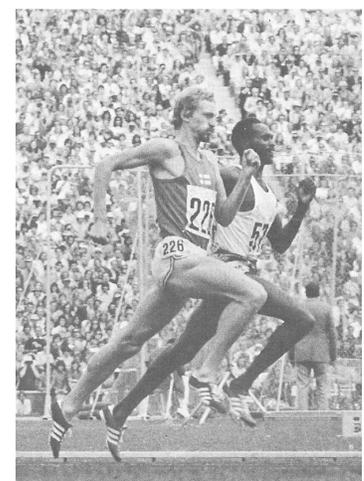


Hill Bounding

"Like a deer going over the fence..."--Lydiard

So not only do we have to have capillary development for muscular endurance, we also have to have muscle fiber development, in other words, power. So by running up steep hills or stairs, we strengthen all this 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, but putting effort or stress on the legs; in other words, to bring resistance to the legs. So the slower we go up the hills, the more resistance we'll get on the muscles. So when you go up a hill, you've got to get your knees up. You must bring your knees up. You must have your hips forward to get your knees up. And you've got to drive off the back leg.

Another thing we do; we do a lot of bounding up a long steady slope. I saw a lot of runners here with their knees bent. They never straighten their legs. Already 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, 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, who I helped in Finland, 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 straight way, there is a picture of him; you could put a board from his heel right through to his head, it was dead straight line, he was getting the maximum drive as he came down the straight. That helped him to win the gold medal. So there is another thing we do.



Pekka Vasala of Finland winning 1500m in 1972 Munich Olympics: photo courtesy of L'Equipe

Another thing I'm always pressing on the athletes; probably the most important development we can get is the development of the ankles – flexible, powerful ankles. We don't want our runners like weight lifters, we don't want our runners like gymnasts; we

want them like ballet dancers. You know how ballet dancers get, 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. It came from their ankles, they could accelerate very quickly with their ankles. So what we do; we 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, which in turn, being on a hill, gives us an extension to an extreme of ankles both up and down which in turn extends both muscles and sinews in the fronts and backs of the legs and strengthens 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, you get a nice balance of resistance in muscle groups and therefore you don't have any problem.



Hill Springing for flexible powerful ankles

So like any other training, you 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 jogging, we will do a little hill training. Not much, just a little, just to activate the muscles in the legs.



Perfect illustration of how ankles move up and down to the extreme during Hill Springing exercise

Then when we finish the conditioning, we usually do four weeks of concentration of hill training three days a week at least. And 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.

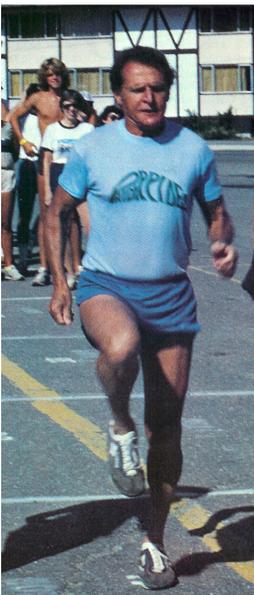
So we warm up for about 15 minutes, run to the hill and then stretch. And then we'll work on a hill for a given period of time. We don't say we'll go up the hill specific number of times, we say we're going to be there for a given time. And in that period of time, we do what we feel our legs will allow us to. Each athlete will concentrate on what he thinks he needs more than any other exercise. In other words; weak in ankles, you will concentrate more on that, etc.. But mix in all the exercises.

When we get up the hill, we'll jog around to let our legs to recover sufficiently before striding down, striding out fast and relaxed. Not down the steep hill, though. 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 (downhill) and they use it to their sprinters even today.

So we try to do this for about four weeks, three days a week, and up to an hour a night if we can.

Spring Drills

And during the anaerobic phase for about four weeks when we concentrate on heavy anaerobic work, we try to bring in technique running. So we do four things basically. Now there are lots of sprint drills people can do, but we just do these four and we find them effective. We've got to get the fast leg action in the upper legs and make this area (upper thighs) strong. So we do high knees. We try to overcome muscular viscosity and trying to get the arms coming straight through. We also try to get power and drive, we do on the flat like bounding on the hill, we do it on the flat. We also try to bring the correct leg action by doing stride-outs¹⁾. First we walk through it, then we skip through it. Then actually once we can handle it, we do the striding out properly. Then we try to get the athletes to run tall, to keep (your torso) up tall.



Arthur Lydiard himself demonstrating High Knee exercise; photo courtesy of *Runner's World*

So until we get the athletes running correctly or running efficiently with a good technique, we'll concentrate doing this once or twice a week. We go down the track, after we are warmed up, we'll do each of these four exercises twice over 100 meters (shorter, say, 50m, for high knee exercise). Then we try to combine these four exercises. We'll get the athletes to think two things: keeping tall and high knees. When they get 50 meters from the straight-a-way of the track, always use the wind behind you if there is wind²⁾, we pick up the speed 50 meters before the straight and go down the straight-a-way as fast as we can, relaxed, keeping up tall and high knees, jog 250 meters nice and easily, 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 times, keeping tall just exactly how we do at the end, picking up the speed, down the straight-a-way with the wind, working on their leg-speed and their technique.



Striding, or "Stride-out", exercise

Now if we can improve the speed of our athletes, it means this: It means the athlete can hold the early speed much more easily, they can conserve their energy because they are running economically correct or mechanically correct, getting more power

¹⁾ This is not just running faster as most people may interpret. This is a specific exercise to teach you to bring your knees high, carry your foot high and bring your foot forward out front. Lydiard termed it "Stride-out" or "Striding". It involves a lot of body coordination; therefore Lydiard recommends practicing this movement while walking through it, then skipping through it before you actually run through it.

²⁾ This is not a resistance work and should not be performed with any resistance (i.e.; head-wind). You need to be able to run fast, relaxed. Running into the wind invariably tightens you up and beats the very purpose of technique work. Running with the wind, if there is tail-wind, also helps to develop leg-speed as does downhill striding.

and drive, in other words, longer strides without being conscious of it, and it's going to help in the finishing kick. In other words; a lot of runners do lots of long long running, and they can't capitalize on their good condition because they don't have the speed to do it.

When we go through all this, I make all my runners sprint in sprint races at a club level, even in the handicap sprints. Distance runners hate sprinting because they think they'd look like fools, but if you want to be fast, you've got to sprint. I've taken three and six minutes off the marathon runners times; one man from 2:15 to 2:12 by working on his actual speed¹⁾. Speed development is important to marathon runners as well as track runners. So every week, 52 weeks a year, runners should be doing something about their speed, conditioning for it, working on technique, and generally working on their speed²⁾.

by Arthur Lydiard
April, 1990
Osaka, Japan



Arthur Lydiard at the 1990 Osaka Clinic:
photo courtesy of "Runners" magazine in Japan

¹⁾ Lydiard took over the training of Terry Manners of New Zealand for 1974 Commonwealth Games marathon. Manners was known as a mega-mileage runner but Lydiard cut back his training volume and worked on his speed with drills and shorter races. He cut his marathon PR by 3 minutes from 2:15 to 2:12 and won the bronze medal in the Games.

²⁾ It should be noted here that Lydiard is not talking about "speed" developed by anaerobic repetitions. "Pure sprinting speed" can be developed by technique drills and/or hill exercises advocated by Lydiard in various forms.

How to set up a training schedule

1. Count back from the first important race date. How many weeks?
2. Allow a week to ten days for Freshen-up (depending on the event).
3. Allow six weeks (including freshen-up), or four to five weeks for Co-ordination training.
4. Allow four weeks for Anaerobic Development.
5. Allow four to six weeks for Hill Resistance Training.
6. Marathon conditioning training is time left, hopefully 10~12 weeks.
7. Marathon Conditioning Period (10~12 weeks or as long as possible):
 - A) Conditioning starts with only aerobic running (flat and hills).
 - B) Then include a day of easy fartlek and strong runs over 5 and 10k.
8. Hill Resistance Period (4 to 6 weeks):
 - Hill training two or three days a week.
 - One day a long aerobic run.
 - Other days for leg-speed or easy aerobic running.
9. Track Training Period (10 weeks):
 - A) First 4 weeks: Anaerobic Development Training:
 - Anaerobic training (i.e.: repetitions, fartlek, etc.) two or three days weekly.
 - One day a long aerobic run.
 - Other days for sprint training or easy running.
 - B) Last 4.5 ~ 5 weeks: Co-ordination Training:
 - Sharpeners, development races (under- and over-distances), fast relaxed runs.
 - C) Freshen-up: 1 week to 10 days.
10. Continuation of racing
Race Week / Non-Race Week

