

Where Have All The

RUNNERS GONE

PART 1 by Brian Taylor

New Zealand distance running has a much-celebrated history. For a country our size, what we have been able to achieve with intuitiveness, practical thinking and inspiration has startled the rest of world. This was certainly the case with the intuitive thinking of Lovelock and the inspired coaching of Arthur Lydiard, who not only guided much of our spectacular success, but was instrumental in the total revolution of endurance training that influenced more recent champions such as John Walker, Dick Quax and Rod Dixon. Not to mention a host of international stars such as Lasse Viren, Peka Vasala and Frank Shorter.

Starting with the Halberg/Snell era and continuing with Walker, Quax and Dixon, running really took off in New Zealand, as it did elsewhere in the world. The reason was clear - the performances of these athletes inspired others such as Anne Audain, Allison Roe and Lorraine Moller, plus countless ordinary runners, to their own relative greatness.

Over the last 15 years however we have seen a steady decline in New Zealand distance running. There has been no performance close to gold, and even in events like half marathons the average time has dropped away. Yet, at the same time world records have been shattered to an extent many thought impossible. Quite simply, the rest of the distance running world seems to have passed us by. This two-part feature article looks at why, and what we might do about it.

GENETICS VS ENVIRONMENT

Distance runners from Central and North Africa, (and more recently South Africa), now dominate the world. The records they have achieved in the last 10 years have astounded the world. On the surface they appear insurmountable. In an article entitled "Black Magic" Dennis Campbell states that athletes from Kenyan, Ethiopia and Morocco are dominating distance events because of aerobic prowess, which he seems to imply is more genetic than anything else. However, while genetics 'is' a factor, close examination reveals that environment may play an even greater role.

In Africa, the lifestyle led is simple, but totally effective for developing endurance for running. Living in somewhat low level technology communities requires that they travel to most places on foot. The most efficient way to do this is to jog, and from a very young age travelling on foot is the only way most people get around. The result over a 10 to 12 year period is a huge development of aerobic conditioning. By the age of 16 to 19, a running prowess emerges and they are picked up as having potential as world beaters.

It is at this age however, that their pattern of development changes. When one examines the typical African runner's development, one finds that there is 'no longer' any long term serious endurance running. Training is intensive and designed to produce immediate results, particularly for those who obtain running scholarships to American Universities.

Similar to African distance running, and starting with the magnificence of Jesse Owens in Berlin's 1936 Olympics, 'African Americans' have dominated sprinting, jumping and similarly explosive sports throughout the world. Their presence is a factor in any Olympic Games. However, when one considers the circumstances in which their ancestors came to North America we find that the reason African Ameri-

cans are the greatest athletes of all time is mostly genetic.

African American success hails from a 200-year genetic selection mechanism. Through the 18th and 19th century this selection mechanism was for the slave trade, but would ultimately provide the source of top sports people in generations to come. The conditions on the transport ships between Africa and America were horrifying and only the very strong, both physically and mentally, survived. Once in America they then had to survive the rigors of exceedingly difficult living conditions. The result has been the emergence some of the most magnificent



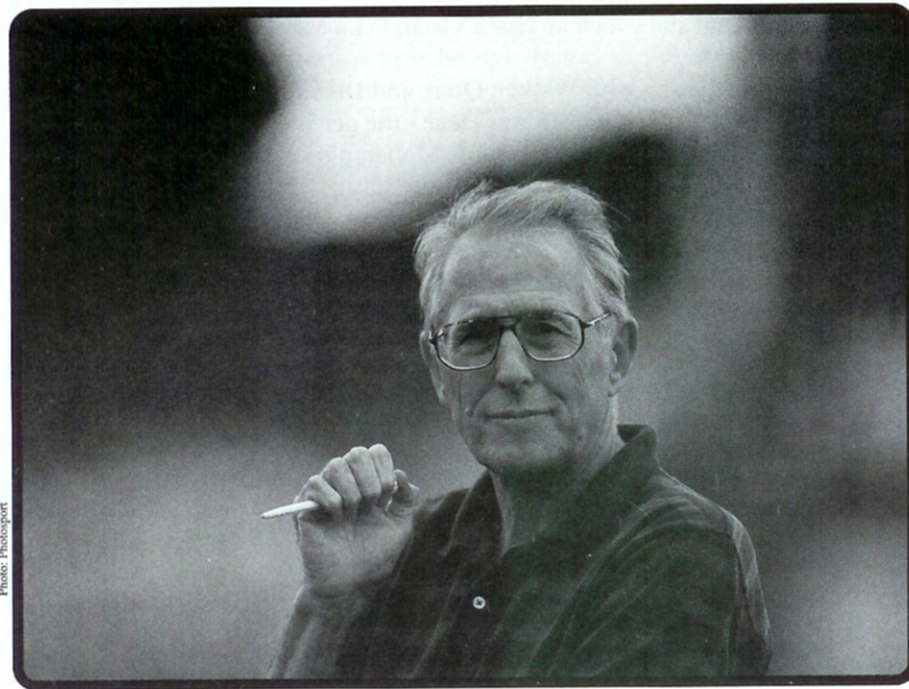
Africans have an environmental advantage.

sporting people we are ever likely to see. What we find here is that genetics has probably been the single most significant factor contributing to their sporting success, regardless of what training they do.

Now, examining the intensive training methods employed by Africans and most American universities one finds a situation

geared towards immediate gains. It is a regime of intense training for demanding track, cross-country and indoor races covering a very large part of the year. There is little time for a proper strategic training plan. Of course this is not quite the same problem for those African runners on American scholarships. As mentioned earlier, their lifestyle as children develops an enormous aerobic base, which readies them for situations such as American University athletics. What we find however is that there are relatively few European Americans performing well in the middle and long distance events, even though they are doing essentially the same training as Africans who are on the same scholarships.

Here in New Zealand, it appears that a number of coaches have picked up on these intensive training regimes and argue that if they produce such stunning results 'out of Africa' then it should do the same here. However one must understand that it is



Coaches such as John Davies have used 'Lydiardism' to great success - why aren't others!

more than merely the training; it is the lifestyle that most third world runners lead, of long distance running from a very young age, that provides the basis for their success.

ONCE WERE RUNNERS

All those who were runners in 1962 will remember Peter Snell's magic 800m world record in Lancaster Park. What is seldom remembered is that in 1963 he also won the New Zealand Cross Country Championship - such was his level of endurance.

John Davies, who won Olympic 1500m bronze behind Snell in 1964, finished as high as fifth in the national cross-country champs. Just a few months before John Walker became the first person to break 3:50 for the mile, he was fourth in the World Cross Country Championships. Anne Audain, Lorraine Moller, Allison Roe, Heather Mathews and Diane Zorn, all Commonwealth, Olympic and world championship medallists or finalists on the track, were members of the New Zealand cross country team that finished second in 1975's world cross-country. Rod Dixon won the New Zealand Cross Country Championships in 1971, one year before his bronze medal at the 1972 Olympics. A year later he finished third at the world cross-country.

The list goes on and on, and the evidence is clear. These athletes are our best middle-distance runners because they had developed an effective endurance base by making sure they had times during the year when they concentrated totally on long running. Directly or indirectly, every single one of these runners

was under the influence of Arthur Lydiard!

THE SITUATION TODAY

It is obvious to all involved in New Zealand athletics today, that there has been a tremendous drop off in people taking up the sport, particularly running. Reasons are many and varied, ranging from the availability of newer and more interesting sporting activities to young New Zealanders not being as tough and dedicated as they used to be. John Walker, in a recent Sunday Star-Times article, even suggested that schools are not teaching young people to win anymore, resulting in teenagers going soft. While I totally agree that New Zealand athletics is currently in shocking shape, Walker's reasoning is arguable. John can't have been to the New Zealand secondary school champs for a while. The 1999 event revealed some 1700 teenagers trying just as determinedly to win as I remember them

doing 25 years ago when I was a young teacher. To me, this demonstrates that the competitive edge is still very much alive. However, something is definitely going wrong when these athletes leave school. All this interest and talent is going down the drain as a result of coaching that has gone completely off the rails.

Changes in modern society deem that we have become oriented towards short term gains with limited interest in long term strategic planning. We seem to want running successes quickly rather than spending time on endurance-based training regimes and waiting until the runner is fully conditioned for the best possible results at an age when he or she is fully mature. Instead, what we see is that in the face of overwhelming evidence in support of endurance trained runners, there are coaches who still persist with diets of daily interval training. The result is instant progress, but limited long-term success. Sound familiar New Zealand?

WHERE HAVE WE GONE WRONG

With this emphasis on high intensity training and racing periods, as advocated by some coaches, what we see is a rapid rise in performance levels and then a levelling off followed by very slow progress. With limited continual improvement runners soon lose interest before they have even tapped their potential - and who can blame them?

In the case of teenage talent, the sport stops being fun and is often replaced by the social nature of team sports. It never ceases to amaze me that coaches allow, and in some cases encourage, runners to compete in often two or even three races in one day. This is especially evident at secondary school competition, and is a dangerous practice for the young runner.

Teenage runners who are encouraged to compete excessively or carry out excessive anaerobic training run the risk of permanent neuro-muscular damage. Over the 37 years of coaching, I've seen this situation repeated over and over again, where runners with wonderful talent have been gradually destroyed. Only two weeks ago I was saddened by a conversation with an 18 year old female runner who was having difficulty dealing with fact that she had not been able to better the 2:19 800m time she ran as a 14 year old!

Even after the influence of Arthur Lydiard's training success, many distance-running coaches are seemingly ignoring the principles that have been proven time and again. I doubt if

today's top specialist 800m and 1500m runners in New Zealand could perform anywhere near the cross-country feats as mentioned earlier in this article. There is too much preoccupation with doing "plenty of speed work" to make sure their runners are fast enough. The effect is a very limited aerobic base. The result is runners wondering why they can't finish their races effectively.

Yet, despite countless evidence in results, books, documents and studies explaining and proving the reasoning behind Lydiard's marathon-like training methods, too many coaches continue training runners in the same manner as the old pre-1960s interval training regimes that Halberg, Snell and co. stomped all over. Today, even here in New Zealand, it is still occurring right under our noses.

IS EVERY RUNNER REALLY THAT DIFFERENT?

I have often been told that everybody is built differently, and each individual should have a different training scheme to suit their own physiology. I consider this rubbish. It is simply an excuse for runners to avoid doing the necessary distance training. Our one million year old human genes are essentially identical: we all have a heart, blood vessels, red corpuscles and body chemistry, all of which respond in the same way to the same stimuli. The differences only emerge in fine-tuning an individual for racing, and the specifics of the event they race.

Let's try and explain the importance of this endurance in terms of an 800m race. Essentially, the person who is really aerobically fit, provided they have the talent to run the necessary basic pace, reaches oxygen debt (anaerobic threshold) much nearer to the end of the race than someone who is not aerobically fit. And if it is 40 to 50m from the finish, determination is all they need from there. However these days most runners are nowhere near aerobically fit enough, and what we find is that they reach their anaerobic threshold with as much as 200m to go. The result is a huge drop off in pace, a huge amount of pain, and great frustration at not doing as well as hoped.

I have seen coaches with athletes in this situation trying to solve the 'drop off in pace' problem by prescribing more repetitions, arguing that they need more "strength" or "speed" work, on some occasions getting their runners doing hard uphill sprints to improve strength. Invariably the result is that the runner's performance actually gets worse because he or she is already tired. Some get their runners to do weights in an effort to improve their strength at the end of a race. While weights training is a useful supplement to running, it will have virtually no effect on a runner's finishing ability. The whole problem is a lack of aerobic fitness.

Too many coaches don't actually know the difference between aerobic fitness and anaerobic fitness.

They don't realise that it is aerobic fitness that enables a runner to

complete effective anaerobic interval training anyway. Most don't realise that adult runners can only withstand up to 18 litres of oxygen debt (less for women & a lot less for teenagers), and that any more repetition work actually tears the runner down. Nor do they realise that any more most certainly will not get them to run faster, because they are already running at their maximum anaerobic threshold. No matter what they do they cannot run any faster!

In this country we have far too many coaches who haven't the faintest understanding of these really quite basic principles. Some have no idea even of what needs to be done to produce effective aerobic fitness, let alone understand what happens

when an athlete reaches anaerobic threshold. I have had many coaches say to me, while their runner slogs their way through yet another repetition, "oh this is only an aerobic rep it won't do them any harm." What is most disturbing is that some coaches have no racing experience provincially, let alone nationally or internationally. They use a 'green finger' approach while taking an "I know better" attitude. Inevitably and invariably they gradually ruin the runner.



Five time Olympic Champion
Ian Ferguson applied
'Lydiardism' to his training.

WHAT IS REQUIRED?

Often I hear coaches arguing that the Lydiard approach has been superseded by "newer" training methods, and that we have moved on from "those days." Well there doesn't seem to be much evidence of any improvement since Walker, Dixon and Quax - and Peter Snell is as surprised as anyone that his 800m world record of almost 40 years ago is still the fastest run by any New Zealander!

There is no way around it. If you want to achieve your potential, then you have to do the kilometres and lots of them. For a mature athlete, this means starting a buildup of around 160km/week for at least three to four months, with the emphasis on three runs per week of nothing less than 90 minutes, with one of these up to two hours or more.

Take a further look at kayaking. The 10 or so Olympic gold medals that Ian Ferguson and Paul McDonald won were as a result of a Lydiard instigated marathon-type training programme. Similarly today, swim coaches at

Photo: Photopost

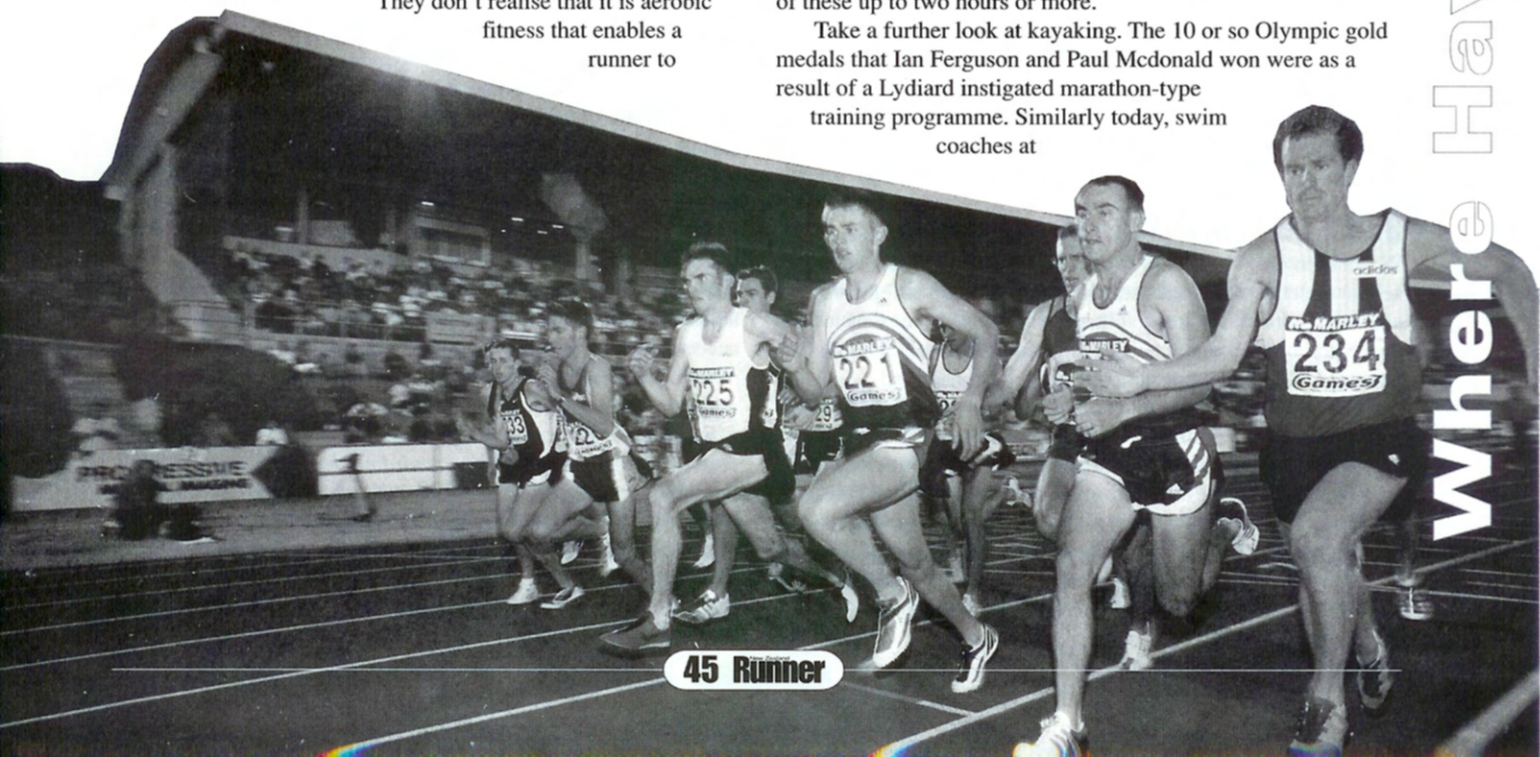


Photo: Greg Chole



Dick Quax, John Walker and Rod Dixon - are we going to see another middle distance era like their's?

Christchurch's Aquagym club have 17 to 20 year olds doing 8km per session and 10 sessions per week! That's 80km or some 20 hours swimming per week! Another swim coach advocating these training levels is Danyon Loader's coach, Duncan Laing - and his efforts produced two gold medals!

You see, nothing has changed. It is the kilometres that produce champions, not "speed work." The things that worked 40 years ago still work today, it's just that very few are doing it now because it takes a much longer time to get results. It seems some coaches in this country have gone soft!

HAVE YOUNG PEOPLE REALLY GONE SOFT?

As mentioned earlier, I believe young runners are just as determined as they always were. After all, they are human and those who decide to run seriously take it to a level that requires a great deal of determination and dedication. Toni Hogkinson now, is no less determined than Marise Chamberlain was in 1964. Granted, young people still need encouragement, but it should be encouragement to train properly so they get the best results when they are fully mature. It is when coaches insist that their runners do such things as training at the track throughout winter that youngsters are more likely to be turned off the sport.

Recently I watched runners doing 1000m tempo reps around and around a track. The coach explained to me that it was, "so you have better control over what they are doing." No wonder runners give up, when coaches insist on regimes that lead only to total boredom. And no wonder dedicated and talented youngsters end up in another sport, which while requiring just as much hard work, is a lot more fun!

WHO'S LISTENING?

We all recognise that talent is vital. New Zealand's secondary school athletics show that there is plenty of talent still about, but also that is invariably lost to other sports and activities. Much of the reason is coaching where all too often, long term planning for the individual runner does not appear to be considered.

The real trouble is that a very talented runner will improve, sometimes dramatically, and appear to be on the right track regardless of what training he or she does. Some runners do quite well despite the coach, because they are so talented. Had Sebastian Coe adopted a Lydiard type programme his world records would still be 20 years away from being broken. It is those last six seconds of improvement over 1500m, or three seconds over 800m, that requires all the kilometres of training!

No matter how much talent is evident, it is a complete waste unless there is effective coaching. Our talented youngsters need appropriate advice. They need to understand that they will gain better long term results if they do less anaerobic interval work especially when they are young, and more aerobic work. And that they might not improve quite so rapidly at first but they will reach much higher levels than they could ever have dreamed of later.

If it wasn't for the enthusiastic efforts that John Davies and others are making with events such as the Marley Games, New Zealand track and field would be very bleak indeed. Athletics New Zealand should be making a much

greater effort in using the experience of coaches such as John in a proactive way. John, and others who have been internationally successful over a long period, should be paid to work with and educate other coaches. Of course a number of coaches would take no notice of such advice, but we should at least be trying.

It is very sad that athletics in New Zealand has done virtually nothing to ensure that Lydiard spreads these, his principles, in a strategic way. While he still receives many invitations to speak from all around the world, here in New Zealand he has been almost a recluse, travelling around the country to speak only when asked to by individuals. He is one of the greatest coaches of all time, yet the sporting body here has never really used his successes in an effective, co-ordinated and continuous way.

Perhaps there is logic in developing a plan for an athlete and coach to receive performance-based financial assistance, but only provided they make use of coaching assistance and support programmes. Any coaches could apply, but they would have to have their training methods assessed and approved before they and their athletes could receive assistance. As there would be limited money the system would have to be contestable, where only those with the most effective programmes would be successful. But I fear that this would not be an easy concept for New Zealanders to swallow.

One thing is for sure, until we get coaching back on track again (no pun intended) we really don't have any hope at all, especially against African runners. We have to match their early childhood life style with effective endurance training if we have any chance of success. The training Arthur prescribed enabled his runners to develop a very high aerobic base that was at least as great as the African runners had developed. John Walker, Rod Dixon and Dick Quax did it again 15 years later when the African runners were really emerging. I believe we have the talent in this wonderful country to repeat these Olympic successes again.

Brian Taylor represented Otago, Canterbury and Alberta, Canada in cross country and track from the early 60s until the early 80's, and was the Otago record holder for the mile and 6 mile. He was the main influence behind the successes of the University of Canterbury Athletic Club during the late 70s, and personally coached runners such as Martin Couldwell (NZ rep), Brian Rhodes (Canadian rep) and his own wife Prue, who was a three time world veteran champion.

The Way Back

Brian Taylor

New Zealand is about to send its smallest ever contingent of distance runners to an Olympic Games. The question is “why?” Continuing on from *NZ Runner 106*, where reasons were explored as to why New Zealand distance running appears to be slipping behind the rest of the world, Christchurch coach and scientist Brian Taylor looks at how New Zealanders might turn around that trend.

Every runner has heard about terms such as aerobic, anaerobic, oxygen uptake, fast twitch, slow twitch and anaerobic threshold. Yet, from national champions and representatives to recreational fun runners, many are unsure how these fit into their training. Understanding these terms is the first step in appreciating the importance of endurance training which is fundamental to the return to our high world status in middle and long distance running performances.

In the last issue of *NZ Runner* we identified endurance as the missing link in New Zealand distance running. And it is, but the ultimate potential of a distance runner actually involves the development of four areas:

1. slow twitch endurance fibres
2. oxygen uptake
3. fast twitch speed fibres
4. anaerobic tolerance.

The aim of this article will explain and offer ways of implementing these key areas in a way that any runner of any ability can understand and benefit.

Slow Twitch Endurance Fibres

Essentially, everybody is born with relatively specific quantities of red (slow twitch) and white (fast twitch) muscle fibres. How much there is of one relative to the other denotes a person's natural inclination to either speed (fast twitch) or endurance (slow twitch). Specific training will develop either, but endurance fibres have the potential to be developed the most.

Muscle cells within slow twitch fibres develop more mitochondria (the energy site where glucose is released to muscle cells) than fast twitch fibres. Also, trained slow twitch fibres form a closer association with blood capillaries, which transport oxygen to the working muscles via red oxygen carrying corpuscles (haemoglobin). Latest research shows that slow twitch fibres specialise in efficiently processing glucose and large amounts of oxygen for long periods. The development of endurance fibres is fundamental in effective endurance training.

Developing Slow Twitch Fibres

The best way to develop endurance fibres is by stimulating them for long periods of time; i.e.: running for an hour or longer. Arthur Lydiard immortalised this “steady state” or “aerobic” approach. It involves running at an effort that tires

the body but doesn't exhaust it. Over time, a physiological adaptation occurs whereby the body adapts to that effort, enabling the runner to go further and faster, thus stimulating further adaptation, etc, etc.

Steady state running, however, should not be confused with merely jogging. The effort (approx. 75% of max heart rate) must be such that it sufficiently stimulates the body and promotes the adaptation process. Of course, there is a point where too much effort/stimulation becomes counter productive. Thus, steady state training involves efforts where there is a plentiful supply of oxygen through the blood supply – hence the term “aerobic training.” If done too fast effective development cannot occur and many runners do this kind of running far too fast, especially when starting so coaching control is very important here.

To keep within this ‘aerobic zone’, it is vital to build up steady state fitness gradually. A good rule of thumb is to always run at a speed where you could carry out a conversation. Likewise, it is important to gradually build the distance of the runs.

Lydiard found that alternating the distance of runs stimulates the adaptation process best. For example, instead of running 75 minutes every day, he found it was better to alternate 60 minutes one day with 90 minutes the next. He also discovered even greater benefits if one of the longer runs was two hours or more, and that this type of training needed to be carried out for at least three months for optimum benefit.

Oxygen Uptake

Because oxygen transport plays such a big part in the development of slow twitch muscle fibres and hence endurance, it is necessary to develop oxygen uptake as well. When the supply and utilisation of oxygen to the working muscles is increased, the slow twitch fibres will operate more effectively, both for long periods of time and during hard effort.

Effects on the body of increased oxygen uptake are:

- Increased stroke volume of the heart, enabling more blood, and thus oxygen, to be pumped to the working muscles.
- Increase in the number of red blood cells, enabling more oxygen to be carried to the working muscles.
- Increase in the number of blood capillaries in the working muscles, enabling more blood, and thus oxygen, to saturate the working muscle.

Improving Oxygen Uptake

While ‘steady state’ training will improve oxygen uptake, introducing some running which is a little more exacting on the body improves oxygen uptake even more. But remember we are still talking about our ultimate endurance development, which means oxygen uptake training must never stray into anaerobic efforts.

The way to improve oxygen uptake is running at efforts of 75 to 85 percent of maximum heart rate. This can be done in the form of intervals of three to 10 minutes (800m to 3km), with approximately quarter of the distance covered for a recovery jog between intervals. Tempo runs ranging from 5km to 16km are also effective, Arthur Lydiard uses timed 16km runs and controlled time trials over 5km and 10km in his schedules. Timing each km (or mile) is a good way of controlling the effort.

Perhaps the best form of oxygen uptake training is the "sausage session" introduced to New Zealand in 1968 by Roger Robinson. Ideal for group training, it involves a runner leading for the three to 10 minute rep, followed by a suitable recovery jog, then another runner leads, and so on. Best done in park type settings, each leader runs at her or his own effort with nobody passing the leader – faster runners simply run wider on corners while slower runners cut the corners.

It's important to remember that these are controlled efforts at your upper aerobic zone. If you stray into the anaerobic zone, lactic acid build up will soon have a totally adverse effect on your session, and thus the endurance development you're trying to achieve.

Sample Oxygen Uptake Sessions

Sausage or Rep Sessions

- 6 to 10 x 3min/1min rec. (6 x 1km/300m rec.)
no faster than 5km pace/effort
- 6 x 5min/2min rec. (6 x 1mile/400m rec.)
5km - 10km pace/effort
- 2-4 x 10min/2min rec. (4 x 3km/500m rec.)
10km pace/effort
- A mixture of all the above

Tempo Runs

- 5km to 10km runs approx. half marathon pace/effort, (timing each km)
- 10-20km runs approx. full marathon pace/effort, (timing each km)

Fast Twitch Speed Fibres

While distance runners are principally concerned with developing endurance and oxygen uptake, development of fast twitch speed fibres should never be overlooked.

The white fast twitch fibres require more conscious muscular effort to activate than slow twitch red fibres. They contract rapidly, but the related effort can be held for only short periods of time because the fibres use a lot of energy (glucose), therefore, they come into play during explosive events such as throwing, jumping and sprinting. Where distance running is concerned, fast twitch fibres help us in two ways - our finishing sprint and muscular efficiency.

A distance runner can sprint at the end of a long race because he or she has well trained fast twitch fibres along with the developed endurance fibres. However even the slowest distance runner can benefit from improving fast twitch fibres, because they involve considerable muscular effort and use large amounts

of energy. By training them we improve the muscular efficiency of the very movement of running.

Developing Fast Twitch Fibres

For distance runners, this is best done via sprint training and hill training.

Sprint training involves regular controlled stride out and drill sessions similar to the training sprinters undertake on a daily basis. This stimulates fast twitch fibre development, but it also improves flexibility and the biomechanical efficiency of moving at speed.

Lydiard has always stressed sprint training, but stresses equally that because this is often a foreign training method for distance runners it should be implemented very gradually. Too much too soon could lead to injury, but a reasonable amount on a weekly basis will actually keep injuries at bay because of the improved flexibility.

For stride outs, six to 10 reps over 50m to 100m are ideal. However, there is a danger of going too fast for too long and putting yourself into the anaerobic zone. The point isn't effort, but efficiency at speed. The pace should be crisp, but the effort controlled, and recovery between reps at least 90 seconds. A slight tail wind or very gradual down hill (5 degrees) to promote speed without effort is great. Indeed, these sessions could be done instead of an easy recovery run.

Hill running, generally thought of as a general endurance tool, is actually even more valuable to develop a good finishing kick. Many runners find they cannot finish races fast even though they have done some sprint work. They tend to try to do more speed work, when the answer is actually hill work.

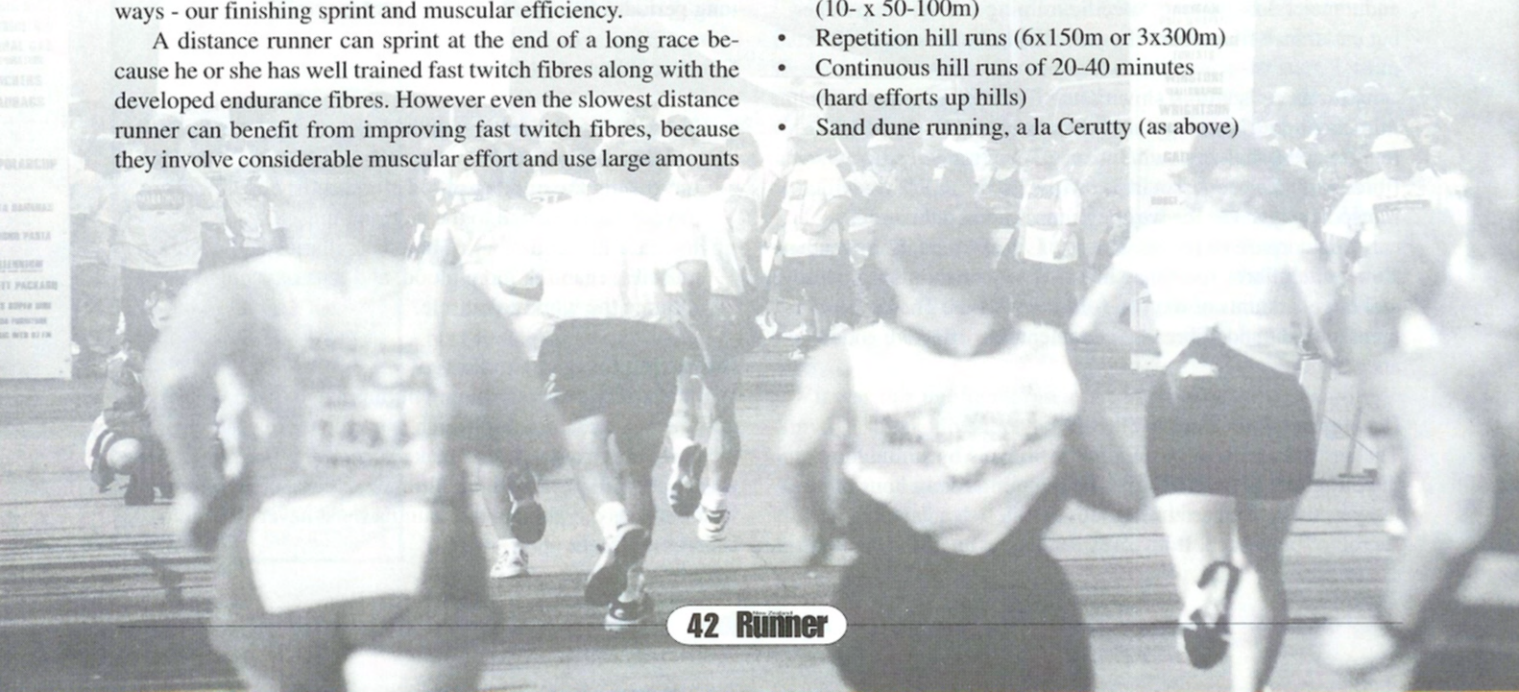
Speed, remember, is directly related to muscular strength. Towards the end of a distance race, runners are muscularly fatigued and often struggle to produce the finishing speed that training or natural ability would indicate. In short - they are lacking the muscular strength to utilise their speed.

It is in this situation that Lydiard found hill running to be so effective. All his schedules include a period of hill training to develop that crucial speed/strength combination, and many athletes since have found that hill work is the single most important aspect of their training. Australian coach, Percy Cerutti, used sand dune running to similar effect with athletes such as Herb Elliot.

Like speed training, it is important to implement hill training gradually. It is also a good idea to combine hill work and strideouts.

Sample Hill Sessions

- Hill reps with a springing action, a la Lydiard (10- x 50-100m)
- Repetition hill runs (6x150m or 3x300m)
- Continuous hill runs of 20-40 minutes (hard efforts up hills)
- Sand dune running, a la Cerutti (as above)



Anaerobic Tolerance

Everyone who's ever run hard in a race will know that 'burning' sensation in the legs, and sometimes the shoulders and arms. When an athlete experiences this it's because they have stepped into the anaerobic zone, where the energy needed to fuel exercise can no longer be met by oxygen supply. While improving endurance will delay moving into the anaerobic zone there does come a time when you have to run much faster than you normally train and aerobic energy supply is not enough. It is called oxygen debt, and there is little you can do to control it, except slow down. However, with specific training, the body can delay the onset of oxygen debt and this can be added to the positive effects of the endurance training base.

Even though oxygen supply is not sufficient, the body is capable of continuing for a limited time. This is because the energy system has switched from aerobic (with oxygen) to anaerobic (without oxygen) - a special chemical reaction having as one of its waste products lactic acid.

Lactic acid is produced whenever you move. At low speeds it is eliminated by the normal oxygen supply in the blood, (hence the reason for developing a high endurance base), but when you run too fast lactic acid is produced in such large quantities that it spills over into the bloodstream, preventing the muscles and nerves from working properly. This is the burning sensation of which we speak, where athletes simply 'tie up.'

Lactic acid is a fairly strong biological acid and if produced continuously for a long time, it will cause the blood to become very acidic (have a low pH). This is when athletes become very run down, irritable, and don't run well. This is particularly dangerous for teenage runners - the damage can be permanent - hence the earlier emphasis on keeping steady state and oxygen uptake training at controlled efforts as well as keeping a total control on anaerobic training.

However, even though prolonged fast running produces lactic acid in large amounts we are also able to produce other chemicals (alkalis) that buffer the lactic acid by converting it into another less acidic chemical. Like the fast and slow twitch fibres, you are born with a maximum capacity of alkali-buffers. Runners who seem to be able to last so well in a fast race or who don't seem to take long to recover invariably have developed large quantities of alkali-buffers. However, the alkali-buffers are short lived in the body and there appears to be a defined period of time they can be utilised. Adult males can only withstand up to 18 litres of oxygen debt max, in women it is less and in teenagers it is much less. No matter what training you do you cannot improve your anaerobic tolerance beyond its maximum, hence the need, at times, to make sure the racing athlete has plenty of recovery jogging to remove the lactic acid with good oxygenated blood.

Developing Anaerobic Tolerance

It is vital to remember that the main purpose of anaerobic training is to simulate the body to produce the alkali buffers. The idea is to deliberately put the body in oxygen debt (when a lot of lactic acid is produced) and lower the blood pH, forcing the body to counteract by producing more alkali-buffers. The problem is that it takes time (48 hours or more, especially for younger runners) to recover from both the physical anaerobic stress and build up the supply of alkali buffers. Because of this, some weeks of anaerobic training are needed to maximise lactate tolerance. Lydiard carried out this training two or three times a week for only four weeks. For some runners a good deal less is

required and it is at this stage that differences between runners becomes clear.

Repetitions of 150m to 400m are best for putting the body into the oxygen debt needed for developing anaerobic tolerance. It doesn't really matter what recovery you have; a minute for 200s, and up to 2 minutes for 400s is a good balance. Also, be wary of too many big sessions such as 20 x 400m, because the more reps, the deeper the oxygen debt and the longer it takes to recover. Likewise, never do workouts such as these on two consecutive days. Many runners do not even do these workouts on a track (e.g. Dick Taylor), a park or smooth bush tracks can serve just as well.

Sample Anaerobic Sessions

- 15-20 x 200m/800m pace/200m rec.
- 12-18 x 300m/800m-1500m pace/300m rec.
- 10-15 x 400m/1500m pace/200-400m rec.

Putting the Training Together

These days, many runners and their coaches mix their training in such a way that they can sharpen quickly for any race, however the necessity for an extended period of endurance running is vital for developing ultimate potential.

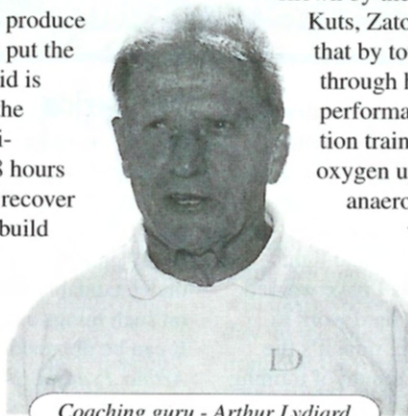
Regardless of the intended racing distance (800m to 10,000m), the requirements on blood flow, capillary development, stroke volume, etc, are the same for everybody. It has been shown time and again, that the best way to develop these traits is via steady state and oxygen uptake training - i.e. development of your aerobic potential to its maximum. Very few coaches appreciate this aspect, or the fact that anaerobic training cannot be fully effective unless one's aerobic potential has been maximised via the endurance and oxygen uptake training.

Most athletes (and their coaches), believe that they must do more repetition and speed work for 800m than 10,000m, so they can run fast enough. Granted, anaerobic tolerance and fast twitch development are vital over 800m and 1500m, but when you compare the world 400m record (43sec) with the 400m splits of the 800m record (1min 41sec = 50.5sec/400m), logic tells us that middle distance racing is actually about having enough endurance to hold the necessary speed for as long as possible.

Having said that, there should always be a certain amount of all training elements during every stage of your training. For example, during the initial endurance phase you should also include stride outs and hill work, and the oxygen uptake training will help stimulate early anaerobic development.

Actually, any type of training will develop to some extent all aspects of a runner's requirements. For example long running done fast enough will develop some anaerobic tolerance. Repetition work designed mainly for anaerobic development if done more slowly and in sufficient quantity, will improve both endurance and oxygen uptake. This was

shown by the training of earlier Olympic athletes such as Kuts, Zatopek and Pirie. Lydiard though, showed us that by totally emphasising endurance development through his marathon type training he could produce performances in his runners far in excess of repetition trained runners. By putting endurance and oxygen uptake development in place, followed by anaerobic development, while all the time working on fast twitch fibres, he also showed that we not only ran better, but could also control our sharpening to perform at our best on a given day. This was always a problem with Pirie's training and invariably coaches who persist in interval training, have



Coaching guru - Arthur Lydiard

difficulty peeking their athletes for specific races.

Guide Schedules

The following schedules are a guide to helping runners better understand the implementation of what I have been trying to explain. They represent the optimum training levels that one might build up to over a three to five year period. Most runners would easily handle half to three quarters of this, but anyone wanting to explore their ultimate potential should already be striving to reach something similar to what is laid out. It is very important to appreciate that the endurance development period as described below represents daily training of one run, any twice a day running is on top of this.

Sample Schedules

The training after this period will depend upon the individual characteristics of the athlete and the extent to which he or she has responded to the training at this stage i.e. how sharp the person has become before the racing period begins.

Finishing Touches

One of the greatest problems runners have is what to do when they begin to race well, especially when they least expect it – i.e.: early in the season. When a runner sharpens, it means that all aspects of their training have come into effect at about the same time, especially the alkali buffers. This means that almost as quickly as lactic acid is produced, it is eliminated, and very little oxygen debt is incurred.

If you run too well early on in the season, it may be necessary to take a complete break from all track work including racing for two or three weeks. It's a very difficult thing to do - especially if you feel so good - but the rewards later on will be greater.

Being at peak is like having a pain-killing injection - you hardly feel any pain. This can also be a problem though, because you don't feel the damage being done. That time trial done too fast, that extra 600 or 200 because you feel so good can upset the balance and lead to overtraining etc.

The thing to remember at this point is that it's time to freshen up and race. Training should revolve around light sharpening and maintenance running. Athletes I have worked with are often asked if they are doing a lot of hard work to sustain their good performances. Almost every time it's the reverse - they are in fact putting in the least amount of training because all the hard work has been done.

Endurance Development (3-6 months)

800m to Marathon

Mon.	1.25hr (18km)	- Easy Steady State (recovery)
Tues	1.5hr (24km)	- Steady State (endurance muscle fibre development)
Wed	1.25hr (18km)	-Sausage session, km reps or timed runs (oxygen Uptake Training)
Thurs	1.75hr (28km)	- Steady State (endurance muscle fibre development)
Fri	1hr (16km)	- Fast relaxed strides or sprint drills (fast twitch fibre development)
Sat	1.5hr (22km)	- Including a timed run or solid tempo run (oxygen Uptake Training)
Sun	2hrs+ (36km)	-Steady State (endurance muscle fibre development)

A. Post endurance (hill period) (1 month to 2 months)- transition to specific training.
B. Pre-Race Preparation (3 to 6 weeks)

Marathon (for 3 weeks)

Mon.	Hill running
Tues.	Steady state running
Wed.	Oxygen uptake running
Thurs.	Longer slower run
Fri.	Recovery run & strides
Sat.	Oxygen uptake training
Sun.	Long slower run

10,000m

Mon.	Hill running
Tues.	Oxygen uptake training
Wed.	Steady state running
Thurs.	Hill reps
Fri.	Recovery run & strides
Sat.	Oxygen uptake running
Sun.	Long slower run

5,000m

Mon.	Hill reps
Tues.	Oxygen uptake training
Wed.	Steady state running
Thurs.	Hill reps
Fri.	Recovery run & strides
Sat.	Oxygen uptake running
Sun.	Long slower run

1,500m

Mon.	Hill reps
Tues.	Sprint training
Wed.	Hill reps
Thurs.	longer steady run
Fri.	Recovery run & sprints
Sat.	Hill reps
Sun.	Long slower run

800m

Mon.	Hill reps
Tues.	Sprint training
Wed.	Hill reps
Thurs.	Undulating hill running
Fri.	Recovery run & sprints
Sat.	Hill Reps
Sun.	Longer slower run

Marathon (for 3 weeks)

Mon.	Hill running
Tues.	Oxygen uptake training
Wed.	Hill running
Thurs.	Steady state running
Fri.	Recovery run & strides
Sat.	Time trial 5 to 10km
Sun.	Long slower run

10,000m

Mon.	Hill reps
Tues.	Oxygen uptake training
Wed.	Anaerobic training
Thurs.	Steady state training
Fri.	Recovery run & sprints
Sat.	Time trial 5 to 10km
Sun.	Long slower run

5,000m

Mon.	Hill reps
Tues.	Oxygen uptake training
Wed.	Anaerobic training
Thurs.	Steady state running
Fri.	Recovery run & sprints
Sat.	Time trial 5 to 10km
Sun.	Long slower run

1,500m

Mon.	Anaerobic training
Tues.	Sprint training
Wed.	Anaerobic training
Thurs.	Steady state running
Fri.	Recovery run & sprints
Sat.	Time trial 3 to 5 km
Sun.	Long slower run

800m

Mon.	Anaerobic training
Tues.	Sprint training
Wed.	Anaerobic training
Thurs.	Steady state running
Fri.	Recovery run & sprints
Sat.	Time trial 2 to 3 km
Sun.	Long slower run

Conclusion

May I commend to you Arthur Lydiard's latest book on running *Distance Training for Young Athletes*. It is a total must for anybody coaching or parenting young sports people, not only for running but for any sport as it can be used as a basis for all endurance type training. The book uses very easily understandable explanations and is as well, a very useful guide on such things as running shoes, diet, etc.

It can be obtained from;

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or email: arthur@lydiard.com