

RUNNING FAST AND INJURY FREE



by GORDON PIRIE (Edited by JOHN S GILBODY)

© 1996-2002 Dr John S Gilbody

TABLE OF CONTENTS

FOREWORDS

ACKNOWLEDGEMENTS

PREFACES

GORDON PIRIE'S LAWS OF RUNNING

CHAPTER ONE - Introduction

CHAPTER TWO - Why Athletes Fail

CHAPTER THREE - Injuries, Technique and Shoes

CHAPTER FOUR - Training

CHAPTER FIVE - Weight Training

CHAPTER SIX - Diet and Vitamins

REFERENCES

FOREWORD

LETTER PUBLISHED IN *THE TIMES* (THURSDAY MARCH 5, 1992):

PIRIE: FORGOTTEN MAN OF ATHLETICS

Sir, Under the heading "Athletics honours Pirie" (February 26) you report the tributes paid to the late Gordon Pirie at the memorial service in St Bride's Church, Fleet Street. As well as his contemporaries, the athletics establishment, both past and present, and the press were well represented.

It is regrettable that this acclaim and recognition comes now, after he has gone, and was not expressed when he was alive. The country he served so well on the world's running tracks thought him unworthy of an honour, while the establishment found no place for his profound knowledge of the sport and his boundless enthusiasm. It must baffle his many admirers world-wide that Britain offered him no official coaching post.

The argument was put forward in your sports letters (December 26) that the regular award of honours for sporting achievements did not begin until the Sixties, after Pirie's time. This is not correct.

In the Queen's Birthday Honours list of June 1955, Sir Roger Bannister, a contemporary of Pirie, was appointed CBE for his services to amateur athletics, clearly for achieving the first sub-four-minute mile the preceding year. In the same list, George Headley, the West Indian cricketer, was created MBE.

Picking at random, one finds in the New Year's Honours of 1958 a CBE for Dennis Compton (services to sport), a similar honour for Dai Rees (golf) and the MBE for the boxer Hogan "Kid" Bassey (for his services to sport in Eastern Nigeria).

Rather ironically, in the same year, Jack Crump, the secretary of the British Amateur Athletics Board, with whom Pirie was often at loggerheads, was appointed OBE for his services to athletics.

Pirie's services to sport far exceeded those of his British contemporaries; athletes or officials. He was a giant of his time and it was his name that drew crowds to the White City and inspired the later Bedfords and Fosters. One suspects that he ultimately paid the price for speaking out and for being of independent mind without the necessary Oxbridge pedigree. The answers lay among that assembly gathered in St Bride's, and ought to be revealed.

Mrs Jennifer Gilbody

ACKNOWLEDGEMENTS

I would like to thank Miss Patricia Charnet, and my mother, Mrs Jennifer Gilbody, for their encouragement during this project. At last I have fulfilled my promise to Gordon to fine-tune, medically validate and publish his work, though I am sure were he here he would have some words to say; probably "about bloody time"!



Purley 2nd XI, 1946 (Gordon on right handside)

PREFACE

Gordon Pirie lived with us for several years up to his death in 1991, and had a profound effect on us all. Of many things about Gordon, what particularly impressed was his physical fitness, and desire for perfection with all things athletic. A good example of this was the time he did some lumber jacking in the New Forest in Hampshire, and proudly boasted how many more trees he cut down than men thirty years his junior. On another occasion, I inadvertently agreed to join Gordon "for a run" on a disused section of railway track, thinking myself moderately fit. Being half Gordon's age, I was somewhat taken aback when, in the time it took me to run one length of track, Gordon had run three! Associated with this, which was humiliation enough, were various comments about my running shoes and running technique (or lack of), as one might imagine.

The original manuscript of this book was written by Gordon, in typical fashion, in 24 hours flat. The 5¼-inch diskette on which the computer file was saved had been tucked away in a sports bag until Gordon rediscovered it, and somehow got folded in half. As a result, it took a full weekend to retrieve the data, and I had to cut out the magnetic media from within the diskette, replace it into a customised new diskette, merge snippets of uncorrupted data into a single ASCII file, and then laboriously convert the file line by line into a recognised wordprocessor format. During this process, Gordon looked on with an enigmatic smile; he always did like to set challenges, however impossible! Revision and editing was started shortly before Gordon's death, and the manuscript transferred to our possession, with Gordon's express desire that the book be published by us in order to assist the training of a new generation of runners. Overall, to get from that early stage to the present book has taken five years of work, and has been a sizeable project for me, albeit one which I was of course determined and happy to achieve.

As you will see, the book is highly controversial, with some radical ideas (one of the reasons it has had to be self-published!), but I believe it is a fitting tribute to Gordon Pirie, which should give an insight into why he was such a successful runner, and perhaps even an opportunity for others to emulate him. The reader may be interested to know of Gordon's two other books - "Running Wild" (published by W H Allen, London, 1961), and "The Challenge of Orienteering" (Pelham Books Limited, 1968). In addition, the writer Dick Booth recently published a detailed biographical account of Gordon's life, entitled: "The Impossible Hero" (Corsica Press, London, 1999), which is available from <http://www.bookshop.co.uk> and <http://www.amazon.co.uk>.

Finally, I am keen to get your feedback about this book, or any reminiscences about Gordon, and would be delighted to receive comments via fax (+44 (0)1256-760100), letter (P.O. Box 7210, Hook RG27 9GE, United Kingdom) or e-mail (john@johngilbody.com). Also, check out my "Gordon Pirie Resource Center" at <http://www.gordonpirie.com>. Recommended newsgroup: rec.running. You can find old newsreels of Gordon at <http://www.movietone.com> and <http://www.footage.net>.
Happy reading!

Dr John S Gilbody

PREFACE

In my 45 years of running, world-wide, I am constantly being called upon to cure injured runners and correct their technical errors. This applies across the board - from young to aged, and from champions to novices. It is in response to this overwhelming demand that I decided to write this book.

There is an entire generation of runners who have suffered severely from the mal-information supplied to them by shoe manufacturers, and the pseudo-experts who pass themselves off as knowledgeable authorities in the popular running press. Some of these runners will never run again. Unfortunately, many runners have been led up athletic blind alleys by incorrect information, and have become either too severely injured or too disenchanted with the sport to continue.

This book is an extension of the activities I have been involved in for the last 45 years - namely, curing injured runners and turning slow runners into fast runners. It is also written for the champion athletes, runners who intend to develop their extraordinary abilities to a point where they will be able to win major championship events.

It is a tragedy that so many super-talented runners reach a point just below that of the great champions, without ever breaking through to the very pinnacle of the sport. These talented runners fail either because they lack a knowledge of the tactics necessary to win a race, or because their technique fails them at critical stages during a race; for instance, being unable to apply the "Fini Britannique", the "Coup-de-Grace", the hard finishing burst which will carry them past their opponents to the finish line ahead. If you are an athlete who wants to stand on the top step of the victory rostrum, you have to be cleverer than your opponents, train harder, race tougher, and never give up at any stage of your running. This book will start you on the road to being the runner you want to become.

It is my hope that this book will release runners from the incorrect information and false commercialism that has damaged the sport and ruined millions of runners in recent years.

Running is a sport, a game that I love.

Good luck in whatever you achieve. It is all "fun running".

Gordon Pirie



GORDON PIRIE'S LAWS OF RUNNING

- 1 - Running with correct technique (even in prepared bare feet), on any surface, is injury free.
- 2 - Running equals springing through the air, landing elastically on the forefoot with a flexed knee (thus producing quiet feet). On landing, the foot should be directly below the body. (Walking is landing on the heels with a straight leg).
- 3 - Any and all additions to the body damage running skill.
- 4 - Quality beats quantity; the speed at which you practice the most will be your best speed.
- 5 - Walking damages running.
- 6 - The correct running tempo for human beings is between three and five steps per second.
- 7 - Arm power is directly proportional to leg power.
- 8 - Good posture is critical to running. (Don't lean forwards!).
- 9 - Speed kills endurance; endurance kills speed.
- 10 - Each individual can only execute one "Program" at any one time; an individual can be identified by his or her idiosyncrasies (i.e. "Program"). An individual can change his or her "Program" only by a determined, educational effort; each individual's "Program" degenerates unless it is controlled constantly.
- 11 - Static stretching exercises cause injuries!
- 12 - Running equals being out of breath, so breathing through the mouth is obligatory (hence the nickname "Puff Puff Pirie").



CHAPTER ONE - INTRODUCTION

The primary reason running has become the most popular participant sport in the United States and elsewhere in recent years is its innate simplicity. Running is an activity which comes naturally to all human beings. It is of course true that some people are born with a particular set of physical and psychological characteristics that make them better runners than the rest, but, nevertheless, everyone can run well at some distance. In addition, running requires no particular equipment or infrastructure; only a simple resolve to "get at it".

Given this innate simplicity, it is maddening for people like myself (I have been in the sport for nearly half a century) to see running become cluttered up with so much bad information - erroneous assumptions ranging from the supposed safest and most efficient way to train, to supposed proper running-shoe design. Much of this information is so distorted and based on so many mistaken principles, that it is impossible for either the serious athlete or the health-conscious jogger to know where to turn for guidance. During my own running career, I have seen the sport mature from the days when it was uncommon for the top runners to train more than three or four times each week, to the present era where sponsorship and product endorsements make it possible for the top athletes to devote virtually all of their time to training and racing.

In the last 45 years, I have participated in three Olympic Games (winning a Silver Medal in the 5,000-metre race at the 1956 Melbourne Games), and have set five official world records (and a dozen or so more unofficial world bests). I have faced and beaten most of the greatest athletes of my time, and have run to date nearly a quarter of a million miles. Along the way, I have coached several of Great Britain and New Zealand's best runners - some of whom have set their own world records. In addition, I aided the late Adolf (Adi) Dassler (founder of Adidas) in developing spiked racing shoes, on which most of today's good designs are based. This brief list of some of my accomplishments is presented in order to lend credibility to what follows.

The information in this book is not based on idle speculations or esoteric theorising, but on more than 45 years of experience as an athlete and coach. I therefore hope that I can now begin to make a rigorous case for the fact that most runners in the world are currently running incorrectly and training inefficiently. This holds true both for people who are running simply to improve the quality of their health, as well as for athletes competing at the upper levels of international competition. Statistics compiled by the American Medical Association indicate that as many as 70 percent of the more than 30 million "serious" runners in the United States can count on being injured every year. This disturbing injury rate is not limited solely to beginners and elite athletes, but applies to runners at every level, across the board.

There are three basic reasons for the injury epidemic currently sweeping the running world, which is making life unpleasant for millions of runners, and destroying many more who are lost to the sport forever. The first is the most basic - very few runners know how to run correctly. Improper technique puts undue strain on the feet, ankles, knees, back and hips, and makes injury inevitable.

The second reason is more subtle than the first, though closely related to it. Most running shoes today are designed and constructed in such a manner as to make correct technique impossible (and therefore cause chronic injuries to the people who wear them). It is a common misconception that a runner should land on his or her heels and then roll forward to the front of the foot with each stride. In designing their shoes, most shoe

companies fall prey to this incorrect assumption. The result is that running shoes get larger and clumsier every year. Far from protecting runners, these shoes actually limit the runner's ability to run properly, and as a result may contribute to the injury epidemic.

The third factor accounting for the current plague of injuries is an over-emphasis on mileage in training, especially "long slow distance" (LSD). Without the constant maintenance of a proper balance in training - including sprinting, interval training, weights, hills and long-running - a runner's body simply will not adapt to the stresses it encounters on a day-to-day basis.

Most runners approach the sport backwards. Initially, they settle into a training regime and go at it. Then, if problems occur, they might think about making changes to the way they run or in the shoes they wear (though few get around to making a constructive change. Most wait for a miracle).

The first thing a runner must know is how to run properly. Everything else follows from there. It is at this fundamental stage that this book shall begin. Before this, however, it might be interesting and helpful for the reader to understand some of my experiences in the sport - something of my roots.

As a small boy in England, I was initiated into the world of long distance running by my father, a competitor in the XC World Championships in 1926, who also ran marathons and served as the race director for a number of 20- and 30-mile road races; the South London Harriers' 30-mile race has been held annually since the 1940s, making it one of the oldest long distance running events. As a result of my father's affliction with the somewhat infinite fascinations of distance running, I was exposed to a constant stream of absolutely mad long distance runners (including a European champion, an Olympic Silver Medalist and a Commonwealth Games winner) at a very early age.

It was my job to take these champion runners around the courses which my father had devised. Since I was unable to run with the men at the age of ten, my only alternative was to guide them around the courses by bicycle. Chief among the lessons I learned from these accomplished (and slightly eccentric) athletes was something of the habits of top-class distance runners. At times they seemed crazy. They were extremely aggressive, and often at war with the world. Remember, this was at a time when it was extremely uncommon to see runners on the streets and roads. I recall particularly the choleric disdain in which they held members of the "civilised world" - a world they seemed not to consider themselves a part. This confrontational attitude would often frighten and embarrass me. I would cycle off ahead of the runners I was guiding in order to avoid finding myself in the middle of an uncomfortable confrontation with an angry motorist, cyclist or pedestrian. The runners, many hardened by the depression, and some products of life in the coal mines, truly believed that the roads belonged to them while they were on a run. If one of these free spirits encountered a sharp bend in the road, they had to run the shortest possible distance around the bend, crossing the road with the result that traffic in both directions screeched to a halt.

They were always spoiling for a fight, and many an angry motorist was ready to oblige. Their aggressiveness increased with the difficulty of the course they were running. An extremely tough one in Surrey had several very big, very steep hills which rose as high as 400 feet. On a run through these chalk hills in the North Downs, it was impossible to detect any of the runners' reputed relish for a tough climb. The hills served only to make them more and more belligerent, and more and more angry.

The late Tom Richards, a Welsh ex-miner, was typical of these runners. He was, until his death in 1985, a real hard bastard on a training run. His intense nature won him a Silver Medal in the 1948 Olympic Marathon. Tom ran the last twenty miles of that race about

100 yards behind the eventual winner, Cabrera of Argentina (in fact, no one told Tom he was in third place most of the way). He was not quite able to make up the deficit in the final miles and finished just 15 seconds behind the Argentinian. Both he and Cabrera overtook Gailly of Belgium inside the stadium.

Tom Richards was one of the athletes with whom I first began to run in the 1940s. Tom and runners like him were always experimenting with special diets or drinks intended to improve their racing performance (some things never change, do they?). They did everything in those days by trial and error - just like today! Nevertheless, they did make mistakes that would seem quite obvious to us now, like taking strong, heavily salted or sugared drinks to keep them going. As a result, it wasn't uncommon then for an exhausted runner to be bent over with stomach or leg cramps at the end of a marathon - a direct consequence of these highly concentrated drinks. It was typical at the finish of such races to see stretchers bearing cramped-up runners being attended to by medical personnel. In fact, the men (there were no women running long distance races in those days) who did not cramp up severely were a rarity. It seemed as if the only reason to run a marathon at all was to enlist sympathy from friends and loved ones, who were sure the runner was breathing his last.

The Coulsdon Marathon finished outside the Tudor Rose, a popular local pub. Consequently, a good, strong, tough Welsh miner could finish the race, be dead on his feet, and still manage to shuffle another 100 yards to the Tudor Rose; there to down a dozen pints of good English beer to prevent his collapse (or, perhaps, to hasten it).

An old runner named Bailey, aged well into his seventies, was a constant bane to race officials who did not particularly want to stand around after dark waiting for him to finish. During one particular event, a race in which the runners had to cover the same loop three times, officials familiar with Bailey's reputation for late night finishes determined to capture him after two laps and physically remove him from the course. They underestimated the tenacity of this stubborn old man, however, and it took half a dozen officials, some only half Bailey's age, to catch him and remove him from the course. As they carried him away, his legs continued running, free-wheeling in mid-air. Old Bailey was determined to get in as much mileage as possible.

Another race, this one around Windsor Castle and the beautiful Windsor Great Park, took place on an extremely hot day. Most of the runners were wiped out by the heat, either because of their various poisonous drinks, old age, or simply because they were unfit. Even the winner, Griffiths of Herne Hill Harriers, struggled across the finish line looking more like a hospital case than a champion runner.

Incidentally, Windsor Castle was the starting line for the 1908 Olympic Marathon, so that King Edward VII could view the start. From there it was 26 miles and 385 yards to the finish line at the site of the ex-White City Stadium - the marathon distance which has survived to this day.

From the above you can see that my attitude to running has been coloured somewhat by being brought up with a generation of running "idiots" - not at all a term I use in a derogatory way. These men exhibited a good deal more courage than common sense or sound training methods, like many runners today, but they did the best that they could. Luckily, in many ways, there wasn't much in terms of scientific data on the effects of different types of training available in the 1940s, but then those early runners were victims of the same type of athletic ignorance which so many runners still suffer from today.

Running ignorance refers to a runner who goes from one frustration to another because he or she knows absolutely nothing about the effects of training on the body. This athlete

may be Summa Cum Laude or a world champion. What I learned from those early pioneers was a great deal about the psychological aspects of distance running - chiefly that if a runner can convince himself or herself that a task is possible, the battle is half won.

On the other hand, an "Athletic Ignoramae" is a runner of a different nature altogether. He is like the great African runners who race without presumptions or preconceived limitations. He has no fear of lap times or of a fast pace. He simply runs his opponents off their feet.

It is amazing to consider that even though US runners have all the scientific help and assistance the modern world can devise, the "Athletic Ignoramae" from Africa regularly beat the hell out of them at the World Championships. It is, tragically, even more amazing when these same "Athletic Ignoramae" are imported into US Colleges and destroyed. They are like flowers - flowers bloom better and for longer when left unpicked!

Even in recent times, there have been runners like Alberto Salazar who believed that he could never develop a sprint finish because of the physiological nonsense scientists fed him. All that was required was for him to identify which aspects of his running character needed to be developed so he could sprint, and then to develop them!

My own journey to the top of the heap in international running began when I saw Emil Zatopek demolish the world's best over 10,000 metres at the 1948 Olympic Games in London. At the time, Zatopek was considered something of a phenomenon. His domination of the sport was attributed to an unnatural level of physical ability. Completely overlooked in the so-called experts' evaluation of Zatopek was his absolutely uninhibited style and the terrific training loads he subjected himself to. Zatopek's performance in 1948 lit a fire in my imagination.

I made up my mind to stop being a spectator. I did not go to another session of the Games. I stayed at home, training hard, from that day on. There are few other athletes in the world who are willing to make that kind of commitment. They want to be spectators too! But for me, it paid off with several world records, an Olympic medal, and, finally, three victories over the great Zatopek himself.

At a time when traditional wisdom frowned upon young athletes training hard, Zatopek's performance demonstrated that what was needed to reach the top was not more caution, but more hard work, study, discipline and courage. Zatopek's races in the 1948 and 1952 Olympic Games opened the door for athletes who came after him. He demonstrated that an athlete must train two or three times a day, year in and year out, in order to maximise their ability. With the example of Zatopek before me, I was ready to attack the running world with a vengeance. But before I could fully realise my grand ambitions, I needed to make sure I was spending my training time efficiently - that is, employing the proper activities in the proper amounts in my training.

Following the 1952 Helsinki Olympic Games I met the great German coach Waldemar Gerschler. At that time, Gerschler had already spent 20 years working closely with Professor Hans Reindall, a heart specialist, and with psychological experts. His approach to training distance runners was well ahead of its time. He called for a systematic approach to training, which prepared the athlete's body and mind to withstand greater and greater efforts.

Gerschler was the first person I met who suggested it was possible for me to train even more. From Gerschler I learned how to produce an absolutely maximum effort. Prior to meeting him I had been training on my own, but his expertise freed me from that

responsibility. I had been training hard prior to meeting Gerschler, but had not really understood what I was doing - nor had I cared much about it, either.

I still employ many of the principles of interval training which I learned from this great German coach during the 1950s. Nearly every top runner in the world today uses Gerschler's interval principles, most without knowing it - a good example was the American Steve Scott.

With Gerschler as my mentor, I was able to lower the world record for 5,000 metres to 13:36.8 in 1956 (Gundar Haegg first broke 14:00 with a 13:58 in 1944). Gerschler's training methods made it possible for me to compete with the world's best for more than 10 years. The example of Zatopek, along with Gerschler's expertise, made it possible for me to become an uninhibited competitor. The crucial point in all this was that I was determined to set aside what was then traditional thinking, in order to do whatever was necessary to eliminate my athletic weaknesses.

The autumn and winter months were spent in cross country racing. I was well known during those years for destroying the competition with insanely fast starts. In 1954, I opened the National Cross Country Championship Race (over a distance of 10 miles) with a 2:03 first half-mile through mud. It was my habit as a cross country runner to attempt to settle the question of who would win as early as possible, leaving everyone else in the field to run for second place.

In the Surrey Senior Cross Country Championships a couple of years earlier, I won the seven and a half miles championships with a time of just over 33:00 in conditions so bad that Chris Chataway (later to become one of the world's best) was able to win the junior five-mile race in only 28:00. In the 1953 Surrey Championships, I broke the course record for five miles en route to winning the seven and a half miles championship, beating Chataway by nearly two minutes.

As early as 1951, just one week after winning the Southern Junior Cross Country title over six miles by a huge two and a half minute margin, I was able to defeat the reigning Senior Southern Cross Country Champion, John Stone, to win the Royal Air Force Championship in Wales. During those years, I ran on the winning team in the Southern Youths (three miles), and Junior (six miles) and Senior (nine miles) divisions - a feat unequalled in English cross country running. In 1955, the late British team manager, Jack Crump, said of my cross country racing successes: "Gordon Pirie is the greatest cross country runner I have seen".

My success was not limited to the winter months or to cross country running, however. I took on a full schedule of international-level track racing during the summer over all distances. Between 1951 and 1961, I faced the world's best at every track distance from 800 metres through to 10,000 metres - and beat many of these "distance specialists".

My training regime made it possible for me to succeed against such runners as Wes Santee (The Kansas Cowboy who set a world record over 1,500 metres) in the famous Emsley Carr Mile in 1953. Michael Jazy (world record holder over one mile) and German star Klaus Richtzenhain (the 1956 Olympic 1,500 metre Silver medalist) were both defeated in 1,500 metre races in 1961 and 1956, respectively, despite the constant claim of the "experts" that I was too slow to succeed at such a short distance. Derek Ibbotson, Vladimir Kuts, Sandor Iharos, Istvan Roszavogli, Laslo Tabori, Peter Snell, Herb Elliott and John Walker, all world record holders, are also amongst my victims.

I did not achieve this unparalleled success due to the possession of any extraordinary physical gifts or a magical training formula. I simply went about my training and racing with a singleness of purpose and determination that was unfashionable at that time, to the point of being downright "un-English". I was able to beat such great runners because I

trained myself to be able to withstand incredibly hard races and still sprint the last 220 yards in something near 25 seconds (on heavy cinder track).

To achieve this, I ran 10x220 yards in 24 seconds - not once, but twice in a single day. I could manage 20x440 yards in 59 seconds with only a 30-second jog to recover, or 12x440 yards in 55 or 56 seconds, with a one-minute recovery jog.

In 1954, I was labelled "crazy" when I promised to lower the world record for 5,000 metres to 13:40. The sporting press called me a running "idiot" (hence my affection for the term). Apparently, my candour at suggesting that both the great Haegg's record and the "impossible" 13:40 barrier might be vulnerable to an athlete willing to attack them with unfashionable determination, was viewed by the press as somewhat presumptuous. It was one thing to strive for an achievement that the world at large viewed as impossible, but quite another to be honest about it. Imagine my critics' surprise when, on June 19, 1956, I ran 5,000 metres in 13:36.8 to become the first athlete to break the "impossible" 13:40 barrier, pulling the late and great Vladimir Kuts (13:39.6) under the magical mark with me. My critics in the press and elsewhere were strangely silent after Kuts and I both broke Iharos's recent world record of 13:40.8.

Despite my competitive record, however, my greatest enemy was never the athletes I raced against. My battle was constantly with myself. I was much more interested in overcoming my own limitations than in smashing my opponents. I was never satisfied with my fitness level. I was constantly adding to my workload, and exploring the absolute limits of my body. There were times when I perhaps went too near the edge, but still I was able to avoid serious injury, and improve throughout my international career, even after many years. I tried every type of running imaginable from very fast sprinting up to hard interval training and running ultra-marathon distances. I ran hills and lifted weights. I trained hard, but never in a haphazard manner. I was always pushing, but knew exactly what I was doing. It takes a careful attention to every detail of your lifestyle, and more than just a simple resolve, in order to improve. It takes planning and knowledge. That knowledge is what this book is about.

So, with a background of almost 50 years as a world class athlete and coach, let us begin. The principles outlined and detailed in the following pages will be called revolutionary in many quarters, but they are the same methods which I employed during my own competitive career, and which have been refined by three decades of training athletes such as Anne Smith (Great Britain), Anne Audain (New Zealand), Alison Roe (New Zealand) and Jim Hogan (Ireland) - all world record holders - together with many other champions. The information conveyed in this book applies equally to the aspiring Olympian, the high school athlete anxious to win a local championship, the recreational marathoner or 10-kilometre runner, and the casual jogger. My intent in writing the book is to provide runners at every level with an understanding of the sport that will make their running safer and more satisfying - not to mention a darn sight faster!

CHAPTER TWO - WHY ATHLETES FAIL

The prevailing attitude amongst runners and those who coach or advise them, is that a failure to attain specific goals is the result of either bad luck, lack of talent, or some form of psychological shortcoming on the part of the athlete. Usually, none of these reasons is true. Athletes fail so often because they are not trained to succeed. Most athletes employ training methods or have lifestyles which make it impossible for them to perform up to their expectations and aspirations. Another important factor is the poor design of most running shoes. The shoe manufacturers have taken on the role of God. They think that He made a mistake in designing man's foot, and that they are going to fix it overnight! I will discuss this latter point in some detail later.

The most common difficulty in the United States (and almost everywhere else in the world) is the obsession people have with measuring everything they do. The object of serious training is to improve racing performance, but to listen to many athletes and coaches one would think that the object is simply to produce impressive numbers for the training diary! Too many athletes get stuck in the notion that the end of training is training; if an athlete cannot string together a certain number of 100-mile weeks or run so many times 400 metres in such and such a time, then he or she becomes discouraged and begins to wonder whether any kind of performance is possible.

Remember, the reason an athlete trains is to *race*.

Set aside right now the idea that impressive training results will automatically translate into successful racing. Progress is not measured on the training track, or by the number of miles logged each week. Progress is determined by what happens when an athlete races.

Training must be adjusted to the athlete's needs on a daily basis. There is no set formula for how often a fit athlete should do his or her hardest training. The athlete and coach must learn to adjust training expectations according to factors in the athlete's life, outside of running. If, for example, the coach wishes an athlete to run 20x200 metres in 30 seconds, but the athlete has had a difficult day at work or school, the coach should reduce the workload accordingly. The athlete may well be able to run 20x200 metres in something slower than 30 seconds (say 33 seconds), or run at 30-second speed ten times, but the effort may set training back as much as a week. They should take an easy day.

Because runners always demonstrate a determination and singleness of purpose rarely encountered in people involved in other sports, they tend to overdo their training when rest is called for (that is, relative rest, not necessarily zero activity). The generally accepted notion is: "The harder I train, the faster I will run". This is not necessarily true. There is nothing wrong with training very hard for a time - even right to the limit - then backing off and having a period of rest. Hard training is very important; but so is rest. Training hard when fatigued is asking for frustration, disappointment, and possibly injury or illness.

A training plan is very important, but it should be infinitely flexible! Too zealous an adherence to a plan can leave a runner flat on his back. In May 1981, I watched Grete Waitz training at Bislet Stadium in Oslo two or three days after a hard race. Her legs were still stiff and sore from the stress of the race, so her training (300-metre sprints) was going badly. I wrote to Arne Haukvik, the Oslo promoter, following that session to ask him to warn Grete that she would soon be injured if she pursued this course of training. Sure enough, Grete suffered a serious foot injury a few weeks later, which caused her to drop out of her world record attempt at 5,000 metres. She lost the rest of the season.

Another common training error is to abandon methods which have worked well only to see racing performance deteriorate. For example, Alberto Salazar was one of the best 5,000 and 10,000 metre runners in the world when he set a world record in the marathon in 1982. Shortly after that success, he changed his training and racing habits in order to "specialise" on road instead of track running, and as a direct consequence of this, he was subsequently unable to match his previous performances at any distance (including the marathon). Salazar had spent many years building himself up into a great track runner, and the speed he developed on the track made him unbeatable in the marathon. Yet, by a very subtle change in his approach to training in favour of the marathon, he lost this speed advantage. The result was disappointment and frustration. Alberto went from being a great runner, who dominated every marathon he entered, to simply being very good. By 1985, he was a slower runner than Mary Decker! Had he maintained the type of training he was doing prior to his great 1982 season, we all know he would have been hard to beat in the 1984 Olympic Marathon. The winner of that race was Carlos Lopes, who just six weeks before had run the second fastest 10,000 metres in history. The two runners close behind him were also seasoned track athletes with the "track advantage". The marathon "specialists" - Seko, De Castella, Dixon and Salazar - all finished out of the medals.

A further factor contributing to the high failure rate of aspiring athletes is that most do not realise the time it takes to reach their maximum capabilities. It is not uncommon for promising youngsters to train with complete dedication for two or three years with one coach, and then, just as they are about to make a real breakthrough, get discouraged by their undramatic (but steady) progress - usually blaming their coach - and consequently change coaches or even give it all up in frustration.

A distressingly high number of these promising young runners are killed off by too much racing over distances that are too long for them, at too young an age. The best runners in schools frequently run two or even three races in a single track meet. These athletes are being praised in the press and by their coaches for this insanity, while they are destroying not only their ability to run, but also their enthusiasm for the sport.

An extreme example of this was the American Matt Donnelly, a gifted young runner in Washington State. Donnelly ran a 4:06 mile as a 17-year-old high school junior, but in the same meet also ran the 800 metres (with a preliminary heat) and the 3,200 metres. Moreover, he had been required to qualify for the State Championships two weeks earlier by running a similar schedule of races. The result? Eight races in fourteen days. The following year he was able to manage only a 4:14 mile at the same venue, and two years later as a university freshman had improved to only 3:47 for 1,500 metres. This talented youngster should have become one of the best runners in America, but instead is now struggling to perform at the same level he did as a schoolboy.

This is only one aspect of the US sports system as regards running. Another example is the university-level athlete, who is a points winner, a professional employee, a tool of the Colleges. Sadly, most are destroyed by this system. In virtually all such cases, the athlete's frustration is brought about by a lack of knowledge; knowledge of exactly what is required to realise his or her potential. It takes a good deal of know-how to reach the top, which most athletes and coaches simply do not possess.

Many runners never suspect they have the ability to run at championship level. Most of us have the ability to be consistent winners in our club or school. A surprisingly large number even have the capability to win at the regional or national level, or to run minutes and minutes faster on our 10 kms or marathons. To reach the upper levels of our potential, however, takes years of dedication and intense, carefully controlled training. Training involves constantly striving to remove weaknesses that hold us back. All the

great runners have spent years working their way up through the local and regional levels before achieving true national or world-class status. Results do not come from the previous month's training, but from years of dedicated development. One recent study quantified this, and found that an average of 10.2 years was needed for champions to develop.

Joan Benoit did not become an Olympic Champion because of what she did in the weeks before the Games - she had laid the groundwork for her great run with years of training. I ran the first eight kilometres of the Auckland Marathon with Joan many years ago, a race in which she won in only 2:31. Her "Super Ability" was only hinted at then (she was already a great runner), and has taken years to mature.

The great African runners who came to dominate road racing in the US have been running all their lives. They did not suddenly appear out of nowhere to beat the best runners in the world, but ran for years before reaching championship level. An African youngster runs as a way of life.

Even the short track distances require a level of dedication which people do not normally associate with sprinting. Valery Borzov, the double Olympic Champion from the Soviet Union, had been working his way up through the various levels of local and regional championship running in Russia long before he "burst" upon the world scene in the early 1970s.

Alan Wells, the massive Scot who won the 1980 Olympic 100-metre title, is known to be a prodigious trainer. He had many years of competition behind him before winning Olympic and Commonwealth championships.

Finally, the example I like best is that of British Olympic Marathoner Barry Watson. Barry was just a good club runner in England in 1968 when he ran with our group, and when I left for New Zealand I forgot all about him. At the Montreal Olympic Games while I was training on the golf course near the Olympic Village with New Zealanders Anne Garratt (now Audain) and Tony Goode, however, "Lo and Behold!", there was Barry Watson proudly bearing the Union Jack on his shirt. His first words to me were: "Gordon, you are a liar! You said it takes six years of hard training to become a champion. It took me eight". It had certainly taken Barry a bit longer than some, but he made it just the same. He was British Marathon Champion in 1976. I stick to that kind of yardstick. If you put in many years of hard work (with a little bit of luck and a lot of dedication), you will become a superb runner, but you have to realise it takes this long, and persevere.

It is important to train hard on a consistent basis. You must treat each day in training as if it were your last. You must be very lucky as well - with no major breaks for injury or illness, or to meet the demands of your social life. It is necessary to give something up to make the most of your gifts as a runner. The paradox in all this hard training is that short rests will be required as well. The body is not a machine! It cannot tolerate a never-ending diet of hard work. Hard training, carefully moderated with plenty of planned rest, must go on all year. You cannot afford to commit athletic suicide at the end of each racing season by giving up completely your hard training.

Before you have taught yourself to train properly, you must become conscious of the necessity of running properly and take steps towards developing correct technique. The best training in the world will be worthless if proper technique is not employed. This vital factor in a runner's development is all but ignored by most coaches. There are coaches and athletes who pay lip service to the importance of correct technique, but few make a serious attempt to teach it. When I point out bad technique, the standard response is: "I'm working on it". They are usually still "working on it" years later, but have not changed at

all. If an athlete is not running correctly, they do not just make inefficient use of their training time, but will suffer injury sooner or later.

Athletes who have access only to the volumes of bad information on technique being pedalled by the running magazines and shoe manufacturers, have no way of discovering the benefits of proper running style. Coaches who hold erroneous notions concerning what constitutes correct technique, or who refuse to acknowledge its importance, are short-changing their athletes, severely curtailing their ability, and inviting injury.

The best athletes in the world - those who compete in the Olympic Games and World Championships - share specific technical traits. Developing these traits is as important to an athlete's progress as developing strength, speed and endurance. Specific information on the development of such proper technique is contained in Chapter Three. In this chapter, we shall examine some common technical errors, and look at ways in which the athlete (with the help of a coach) can correct them.

The most common misconception concerning style becomes immediately apparent by looking closely at a typical pair of modern running shoes. I find it impossible to find running shoes today which are not heavily padded at the heel, and which have a relatively small amount of protective material under the ball of the foot - especially under the toes. Any athlete who has grown up wearing these shoes unfortunately comes to the conclusion that it is proper to run by striking the ground with the heel first. This assumption follows from the way the shoes are designed, but is absolutely incorrect. You will not find athletes in the Olympic Games racing on their heels in heavily-padded running "boots".

An entire generation of runners is being destroyed (and/or prevented from achieving their full potential) because of having to run in shoes which make correct technique impossible. This undoubtedly contributes to the millions of injuries which keep millions of runners from training fully every year.

It is important that a runner uses correct technique from the very first to the very last step of every run. The coach must begin teaching proper technique before any hard training is attempted. It is never too late to begin running correctly, no matter how long you have been running improperly. You can change! Running technique must be viewed as a skill and must be practised like any other skill until it is mastered, and becomes second nature. Let us start at the very beginning, with the person standing to attention in bare feet. Raise yourself up onto tiptoes, and overbalance forward. You must take a step forward to keep from falling over. From the position which results (it is impossible to step forward onto the heel), you should begin to run at a slow velocity - but with very light, quick steps - making sure to feel the stress on the toes. The runner's legs should remain flexed at the knees. A feeling of "sitting" with the seat down "like a duck" is employed with the body upright. An athlete who runs correctly will actually appear to be shorter than other runners of the same height who are not running properly. By keeping his knees flexed and by landing on the ball of the foot on each step, and with the foot beneath the body, the runner will spring along very quietly. As the weight of the runner's body rides over the foot, the entire sole will rest flat on the ground - do not remain like a ballet dancer on your toes throughout the weight-bearing phase. Alison Roe did this, and was constantly injured.

The runner will generate more power and cover more ground with each stride by taking advantage of the springiness and power of the muscles in the feet and forelegs as well as the thighs. The runner's tempo should be at least three steps per second. A person running correctly will make virtually no noise as he moves along. A conscious effort must be made to run as lightly as possible. The runner must be aware of what his or her feet and knees are doing at this early stage (I think about my feet and knees, but avoid visual

checks. Do not glance down constantly like many runners do, seeing if their legs are "looking good"). Try to maintain a quicker tempo than is natural. Don't lean forward.

A runner whose style causes him or her to overstride, striking the ground heel-first with straightened knee joints, is running on a very short road to the doctor's office.

During this initial teaching phase, the runner should hold his arms close to the body without any movement at all, and concentrate exclusively on what his feet and legs are doing. The ankles, calves and quadriceps are going to be working much harder than before. The runner needs to run only about 50 metres in this manner (stressing the balls of the feet, with quick, short steps which utilise all of the muscles in the feet, calves and thighs). Don't lean forward.

The runner must get about 200 steps into these 50-metre jaunts, achieving a tempo of at least three steps per second. The coach must pay close attention to what each runner is doing, and watch each runner's style as they run, making criticisms until proper technique is mastered.

After the runner has become conscious of using the feet and legs, he or she can then add the hands and arms into the running motion. Take everything one step at a time. Make sure the runner understands each aspect of the technique he or she is trying to master before moving on.

At first, the only arm action allowed will be as a direct result of the energy from the feet and legs. The arms should be held with the hands close to the body, and the elbows bent at an acute angle (less than 90 degrees). The exercise described above is then repeated with the arms becoming more and more energetic with each repetition. The forward and backward strokes of the arms should form a quick, sharp, jabbing motion. This is done without excessive sideways movement. By this means, power from the arms will be transferred to the legs. (Note: While it is important that the forearms swing a little across the body, they should not cross the midpoint of the chest, nor should the arms piston in a straight forward and backward direction). The result is increased efficiency and greater speeds, with no relative increase in physical power or energy expenditure. No movement should be made by the trunk! Don't lean forward.

As you run with your hands passing in this arc, at just about the line formed by your lower ribs and up across your breast, carry your hands lightly clenched, with the wrists locked and the palms facing the body. If the palms face the ground, your arms will take up a paddling, flipping action that wastes energy. If your palms are turned up to the heavens, the forearm will work in an exaggerated upper-cutting action which will force your hands too high, lifting the body too much off the ground in a jumping type of action. The object of running is to move forward horizontally at as great a speed as possible. If you keep your palms facing your body with the thumb and index finger lightly clenched, your arms will work in an efficient arc, close to and parallel with the body. The tendency at high speeds is for the arms to swing away from the body out of control. So, keep your hands under control, hooking the hands in close to the body. Your arms should then work in strong, stabbing thrusts. Keep your arm action vigorous and compact, and as tidy as possible. The sharp backward and forward "stabbing" and "jabbing" of the arms will then synchronise with the quick, sharp, vigorous power drive of the feet and legs.

In order to illustrate the power that can be generated by the arms, the coach can have the athlete feel the force that should be applied in the arm movement by driving his fists (in a running action) into the runner's upraised palms. After the athlete gets the feel of the amount of force striking his hands, he can then try the same exercise by driving his fists into the coach's upraised palms. The coach then removes his hands. The athlete must now stop the forward and backward motion of his fists himself, at the same point at which the

coach's palms were before they were removed. This sudden (voluntary) stopping of the forward and backward motion of the hands causes a reaction in the legs (for every action there is an equal and opposite reaction). When the athlete does this in a standing position, he or she will notice a pronounced rotation of the hips and pelvis caused by the sharp, strong "stopping" of the forward and backward motion of the arms. (Note: During running there should be no movement of the trunk. The body should be fixed and motionless, with the hard forward and backward pumping of the arms perfectly balancing the action of the legs. The greater mass of the legs and their powerful action will require a very vigorous action in the lighter, weaker arms for this balance to be maintained. Arms must work hard!).

At this point, the athlete should be able to feel the advantages of: (1) a quick, light step in which he or she lands on the balls of the feet under the body; and (2) an added strong, short and sharp arm motion synchronised with the legs.

Now the athlete is ready to put these two aspects of their running together. The athlete should attempt to run (landing on the balls of the feet) using the same quick, sharp synchronised action in both the arms and legs. If the runner has these two elements in proper synchronisation (accomplished only through practice), they should feel themselves flying along further with each step yet travelling close to the ground (without lifting the knees too high or extending the foreleg too far in front). He or she will look like Lasse Viren! The runner will now feel the power they are able to generate with these strong, yet fluid and controlled body movements. The runner will no longer feel compelled to "stride out" - that is, to throw the feet and legs forward in an exaggerated effort to "bite" more and more ground with each stride. The athlete's stride length will be determined by the amount of force generated by proper use of the feet, legs and arms, and should match the velocity of the running.

Faster speeds will result in a longer stride, but a longer stride will not necessarily result in faster speeds. Don't lean forward.

Overstriding is one of the most common technical afflictions of runners, and one of the most dangerous. The danger in overstriding is that you hit the ground harder and harder with each step, actually jarring yourself to a partial (albeit brief) stop. This constant braking action results in very early fatigue, less than maximum speeds - certainly lower than would otherwise be possible - and bad injuries.

A good example of an athlete whose performances were affected seriously by overstriding was British 400-metre runner Adrian Metcalfe, who in a number of races overstrode terribly for the first 100 metres, before he became exhausted, and his high-jumping, leg-flicking, rope climbing style settled down.

The athlete must constantly pay attention to his tempo, and strive for a quick, smooth, well co-ordinated running action. He must work hard to imprint proper techniques and attitudes onto his mental approach to running. Only by constant attention to the basics of sound technique can the developing athlete hope to make these fundamentals part of his athletic second nature. You have to train yourself to concentrate on every step of every run. The body's centre of movement is located in the centre of the stomach. The arm position relative to this centre of movement decides your tempo. Thus, arms far away, spread out from the body result in a slow tempo, and a close compact posture produces a rapid/fast tempo. A good example is a skater who spins quickly when compact, but slows dramatically when the arms are thrown away from the body. To run faster, therefore, keep tidy and compact.

When the athlete wishes to speed up, he must compact up, quicken his tempo, and try to apply more power within these movements. The result is a running style that belies the amount of effort being utilised.

Great runners employ an elegance of style which makes them appear as if they are running very easily; observe the running styles of the likes of Joan Benoit, Carlos Lopes or Lasse Viren. These great champions were so efficient they appeared to be running very easily, when in fact they were working very hard and moving extremely fast.

It is important to maximise the power which is applied in the fraction of a second that the foot is in contact with the ground. Following this concentrated power phase is a brief rest; a short holiday from effort until the other foot comes into contact with the ground on the next step.

Percy Cerutti, the great Australian coach of Herb Elliott (1960 Olympic Champion who retired undefeated over 1,500 metres and 1 mile) observed that running is not a natural activity, but an unnatural endeavour which the prospective champion has to learn. It takes enormous concentration during training for an athlete to master the subtleties of correct technique. It is important to remember that the athlete cannot talk if he is running properly. If you are talking you are not breathing correctly, nor are you applying yourself to your running effectively. The runner needs to concentrate on what he or she is doing at all times.

To finish off this introductory training session, the athlete should put on a pair of shoes which do not inhibit proper technique (see Chapter Three for a detailed description of the characteristics of a well-designed running shoe).

It is the coach's job to understand the requirements of proper technique, and to make sure that the athlete is aware of his or her technical errors and the means of correcting them. Coaches must moderate the amount of work they ask their athletes to perform during the first days or weeks after learning proper technique. Like any other aspect of training, the athlete's body must be allowed to adjust to the new experience of running correctly. With proper technique, the muscles of the feet and legs, as well as those of the arms and shoulders, will have to work extremely hard. Soreness and fatigue are the natural result, until muscle strength and fitness develop. The coach and the athlete must continue to proceed with caution and care. Hold back training volume, but maintain the frequency of training sessions. Two sessions a day for as little as 10 or 15 minutes each are adequate until the athlete's muscles can cope with the new demands being made on them.

No athlete should make a commitment to running which is less than that absolutely possible given his or her physical ability. At the same time, however, too many coaches and runners today take it for granted that all that is necessary to succeed is a willingness to work very hard, with miles and miles of training and endless stopwatch smashing, and a positive approach to training and racing. You must also run correctly. You must control every aspect of the act of training and racing. It takes close attention to lifestyle and diet. It takes concentration on correct technique every step of the way. It takes a willingness to moderate all aspects of your daily life which may interfere with training. But, most of all, it takes an understanding of exactly what is required to make the best of your running. The rest of this book covers the steps necessary to succeed - to attain the highest level you can. Failure to understand the means and objectives of correct training and technique will lead only to injury and frustration, and an abandonment of that great gift to man - to run like a deer.

CHAPTER THREE - INJURIES, TECHNIQUE AND SHOES

The three subjects cited in the title of this chapter are closely related, and yet, unfortunately, most athletes take injuries for granted - as going hand in hand with hard training - and usually view them as being the result of mysterious accidents. Injuries seem almost to be considered a matter of fate, utterly out of the athlete's control. Even Grete Waitz had this misconception. Grete said in late 1984 that her body was beginning to break down under the strain of all the miles she had run over the years. If that were true, my body would have come apart in the mid-1950s. It did not. Injuries need not occur at all. Of course, there are times when an unseen stone or tree root might send a runner head-over-heels to the infirmary, but most stress-related injuries keeping runners on the sidelines are preventable. This is not to say that running-related injuries are not a serious problem, however, as evidenced by the rapid growth in recent years of a new medical specialty devoted to the care of injured athletes.

It has become fashionable for so-called fitness experts to suggest that running is not the best way to get fit. These experts even suggest that running is not an activity the body was designed to do. This is rubbish! As long as the runner (whether brand new to the sport or a grizzled veteran) is running correctly and training sensibly, there is little to fear from stress-related injuries.

Let us begin our discussion, therefore, by considering the problem of the perpetually injured runner. A runner trying to solve the injury prevention puzzle must start with the most basic aspect of the activity. A person new to the sport or a much injured veteran will very likely need to start at square one. Most people who begin to run, either competitively or for health reasons, believe that all they need to know is the location of the nearest running shoe store. They dash out, pay a large sum of money for the latest running shoes, and start running. Most - about 70 percent according to medical statistics - will be injured before they have broken in their new high-tech footwear, their legs usually being affected first. This injury cycle will continue unchecked until the runner either quits in frustration, or is forced to do so because he or she is too crippled to continue.

It is absolutely essential that the runner wears shoes which make correct running technique possible, and that he or she is constantly supervised until correct technique is mastered. This is the coach's most important job in the early stages of a runner's development. There is no point in running large distances until the athlete has learned to run correctly. I cannot emphasize this point enough. An athlete who runs correctly can train hard for years without any time lost to stress-related injuries. I have trained very hard for 45 years and have suffered only two or three injuries which have stopped me from training. My longevity is a direct result of paying close attention to the way I run, and what I put on my feet. Shoes which enable correct running technique are essential.

In many cases, it is possible to tell in advance what kind of injury a runner will suffer from, by examining the way he or she runs. I can tell an injured athlete what error in running technique they are making from the particular injury they have. A specific injury may be caused by a particular type of running shoe, or a specific error in running technique. Over 70 percent of the running shoes on the market today are causing injuries by their design. By an amazing coincidence, this 70 percent figure corresponds to the percentage of runners who are injured every year.

It is not only essential to learn correct running technique, but equally vital to find a shoe designed to allow correct technique to develop. It is no coincidence that most runners from developing nations, many of whom grew up never wearing shoes, exhibit the best

running technique. We marvel over the incredible fluidity of the great African runners, without ever stopping to consider the source of their grace and efficiency.

Bill Toomey, the 1968 Olympic Decathlon Champion from the United States, made video tapes of 100 champion runners in Montreal in 1976 in order to evaluate their technique. It is common-sense to assume that the best athletes in the world (those who consistently place highly in major championships) share common technical traits. All of the athletes filmed by Toomey used the same basic technique - the same technique I use, and teach to my athletes. The athletes filmed by Toomey all landed on the forefoot. None of the 100 landed heel-first!

While poorly designed shoes and incorrect technique are the most common causes of injuries, however, they are certainly not the only ones. Other causes include: running when ill or before full recovery; poor posture, leading to lower back and hamstring problems; motor vehicles, either knocking a runner off the road or causing injuries by their poor ergonomics, especially after hard running; insufficient rest; poor diet; poisons from various foods; and the environment.

The best way to begin injury prevention is to learn correct technique and practice it constantly. A computer study of pressures on the foot during running indicated that the highest pressure and "wear and tear" zones were at the front and ball of the foot, and beneath the toes. Certainly, when one runs on the beach, one notices that the sand is dug up by the toes. The ball of the foot makes a strong print, while only a soft indentation is made by the heel. Amazingly, despite these straightforward observations, most running shoes are designed with the greatest amount of "protective" material at the heel.

The champion runners, who all have to run correctly, do not make much noise when their foot lands. When the fastest runner runs, he is very quiet on his feet. Excessive foot noise indicates that you are striking the ground instead of caressing it. You are dissipating energy which should be utilised in propelling yourself forward. This shows bad timing. The force to drive you forward should only be applied after the foot has settled on the ground completely. Striking the ground, especially with the heel, causes trauma and makes the runner susceptible to injury.

The nerves conveying tactile sensation from the foot are predominantly located in the forefoot. When the ball of the foot touches the ground, these nerves "alert" the muscles of the legs, which involuntarily react to absorb the shock of landing. If a person hits the ground heel-first, this reaction of the leg muscles will be considerably less, and consequently more shock will be experienced at the point of contact of the foot, and be transmitted to the bones of the leg. This jarring is guaranteed eventually to cause injury to the ankle, knee and/or hip joints.

It is therefore important that a runner lands on the forward portion of the foot, with the knee slightly bent, and with the foot placed beneath the body. By doing so, the runner will make use of the body's own efficient shock absorbers - the arch of the foot, the calf muscles, and the quadriceps muscles in the thighs - and in this way reduce the stress experienced by the heel, shin bone, knee joint, thigh bone and hip joint. It is these areas which are stressed the most when the heel strikes the ground.

An examination of the vast majority of running shoes on the market today reveals that the shoe manufacturers have made the mistaken assumption that runners should strike the ground heel-first. Certainly, their advertising suggests that this is the correct technique.

More and more people are discovering the satisfaction that running provides, and participation in the sport has exploded in the past 15 years. People entering the sport since the mid-1970s, who know nothing but the heavily-built type of running "boot", wrongly assume that it is proper technique to strike the ground heel-first with a

straightened knee. They have made the mistaken assumption that the shoe manufacturers know what they are talking about. They do not! Most of these runners, and many experienced runners, are often injured and constantly fatigued because they have never been exposed to correct technique and footwear. They are being encouraged to run incorrectly by the shoe design.

So, stay off your heels! This rule applies to running on any surface, in any terrain, and at any speed, either up- or downhill - with the exception of running downhill on loose sand or gravel. In the latter case, you should bury your feet heel-first into the ground to stop sliding.

When I run a road race in the US or Europe, in the midst of runners of every age and ability, the noise of their feet crashing to the ground is deafening. This racket is caused by runners slamming their feet into the ground heel-first. A runner must land on the outside portion of the ball of the foot, with the knee slightly flexed. The knee should be flexed so that the large muscles of the thigh can aid in absorbing the shock of landing. The foot must land on the ground directly under the body (not way out in front as is often the case when a runner tries to "stride out", straightening the knee). When I am running with a group of athletes of my own height, I am lower than the rest in my running stance. My relative height is reduced because I am closer to the ground with my knee flexed during the weight bearing phase of the running stride - when the body is passing over the foot. This "low" running posture allows me to stay in contact with the ground longer, and makes it possible for me to generate more power during each contact power-phase with the ground. If a runner is making full use of his feet and legs as shock absorbers, he will make little if any noise when he runs, even on the steepest downhill stretches, because there is no vertical pounding of the feet and legs into the ground. The body will not crash down on the foot, but will pass smoothly over it. For most runners, the timing of this action does not come naturally and takes a good deal of practice. Close attention needs to be paid to correct technique from the outset. A runner must be as concerned about proper technique as a field-event performer or a hurdler. Hurdlers do not go over the barriers two legs at a time, because that technique is too slow. They work constantly at removing even tiny technical flaws, just as a flat runner must. It may be slow-going at first, but the pay-off will be months and years of injury-free running.

The human foot is the result of millions of years of evolution. The shoe companies want to change the design of the foot straightaway. Running in the cumbersome, orthopaedic boots that jam the display shelves in the typical running shoe store is akin to John McEnroe trying to play tennis with a baseball.

Correct running technique will be prevented if the rear portion of the foot is lifted high off the ground by a running shoe with a larger volume of cushion material at the rear of the foot than at the front (I can always catch a girl in high heels). If the shoe raises the heel above the level of the ball of the foot, then the foot will be prevented from carrying out its full range of movement. In the normal case, you start with a flat foot and the calf muscle group fully stretched - the toe pressed into the ground. Your flexed knee sets the foreleg sloping forward. Then the calf muscles become well stretched, practically to their maximum, so that the full range of contraction can occur as the toes are driven into the ground at the finish of the power phase, and prior to the foot losing contact with the ground.

With improper shoes, the heel is already up, and you lose a large proportion of your propelling capability. The result is reduced power, speed and efficiency. Thus, such shoes make correct technique impossible. A shoe with a wedged heel also causes premature contact with the ground by the heel, even before the full stride is completed. The result is

a stubbing gait which is so common amongst joggers. They are nearly tripping themselves up with the heels of their shoes on every step. A high heel is also less stable than a flatter-heeled shoe. Ankle sprains are a very common affliction among runners who wear such high-heeled shoes. It is no surprise that the high heel is quickly worn away - because it shouldn't be there!

American tennis player Cathy Jordan, after missing a shot in the US Open, could be heard on television admonishing herself by shouting: "Bend your knees! Get on your toes!". All great athletes get on their toes. If you want to beat someone in any sport, all you have to do is to get them back onto their heels! Good technique requires the runner to caress the ground with his or her feet, and to land with a slightly flexed knee. But what do we see in the majority of cases? Straight-legged "runners" pounding the ground with their heels. They end up crippled.

People are advised not to run because it will ruin their feet and knees. In 45 years, I have run more than 240,000 miles without any major problems, and with more than half that distance covered on so-called hard pavement. Have I been lucky? No. I have merely employed correct technique, as described, and have been careful about the shoes I wear.

There are few accidents in athletics if a runner is successful (whether in terms of Olympic medals or just years of injury-free running), and there is a reason for this success. The most significant element is correct technique (made possible by good shoes). There is a lot more to running correctly than just getting your feet and legs working properly, however. What you do with your hands and arms is equally important. I have heard a number of well-known coaches tell runners that it doesn't matter what they do with their arms. My response is to ask them if it is okay if I run with one arm behind my back and the other between my legs. They look at me as if I've lost my marbles. Then I put both hands over my head and ask: "Is this okay?". Or, I'll put my hands on my ears and ask: "How about this?". If none of these methods of carrying your arms is correct, and if we eliminate all the incorrect ways of using your upper body and arms (*reductio ad absurdum* in mathematics), we logically should arrive at something that works very well indeed. The best way to get a clear idea of how to use your hands and arms is to watch what the best runners in the world are doing with theirs. You will not find sloppy technique among the vast majority of the best runners. In any sport, the athletes we most admire are those who have the capacity to make everything they do look easy. The champions have an appearance of economy of movement which gives an illusion of ease. Those who are at the top are making maximum use of their bodies with powerful action.

The way the human body is designed and put together demands that certain criteria be met for it to function the way it is supposed to. While it is important to take into account individual differences, the basic biomechanics required for maximum speed and efficiency will be the same for every runner. All humans have joints which bend the same way, and similar muscle elasticity and blood viscosity.

Most runners reading this book will not use their hands, arms, and feet enough. While we use our hands and arms in many activities on a day-to-day basis, the feet don't do much for most people except to give them something to stand on, and get them from place to place in an upright posture (if we are not too clumsy in the process). The same is true for runners. Most runners only use their feet as a place to land on after each stride. The feet spend the vast majority of the time during training and racing on holiday, doing nothing. If runners will just make the connection between their brains and their feet, they will become very efficient indeed. Speed is initiated by strong feet and calves.

A runner, therefore, has to educate his or her feet to be very energetic, and to take an active role in moving around the track or down the road. The feet need to be used in

much the same way as the hands are - with a feeling of control - and in a vigorous action that includes each and every muscle of the foot. The education of the feet is best accomplished by practising exaggerated leg and foot exercises.

My first coach back in 1941 was E.J. Holt. He was a trainer of many champion runners, as well as being one of the organisers of the 1956 Olympic Games. All of his athletes did prancing and bounding exercises initially, to learn to run. We often did this in bare feet, if the weather permitted. We learned to be very conscious of the role our feet could play in improving our running, and inhibited our arm action during this foot-education process so that our minds could focus entirely on what was going on at the end of our legs. Later, as we increased our velocity and skill, we employed more and more hand and arm action. These exercises taught our bodies spatial perception, motor control and the basic "nerve patterns" necessary for correct running technique. You can expect to be very tired and stiff in your feet and legs when you first do this, because the muscles in these areas are simply not up to the demands you are making on them. Keep at it, though, and the soreness and fatigue will pass. (It may help to massage the feet often). In this way, you will become a much better runner.

Correct running should feel like a series of very quick but powerful pulses, with the arms and legs working in unison, followed by a period of relaxed flying between each power phase. Try to take a quicker stride than is natural. Quicken up! Get your feet back onto the ground as quickly as possible. This can be achieved by strong arm-stopping, which causes the foot to land quickly but lightly on the ball/front of the foot. Do not wait for the leg and foot to drift away and land on its own out in front whenever it wants. Make it snappy and quick. Do not float along. Watch runners like Joan Benoit and Carlos Lopes; both employ quick but very powerful running actions.

Breathing should match the quick, sharp rhythm your arms and legs have established. Breathe out with quick, short puffs, almost panting like a dog. Do not breathe in deeply! Like everything else we've dealt with so far, this powerful running action (including proper breathing) takes a great deal of practice. You will hear a lot of runners encouraged to relax in the midst of a very hard training or racing effort. The relaxation should take place during the short passive (stationary) rest period between the power phases of each step of your running. Concentrate very hard on mastering this brief period of relaxation. A lazy, "relaxed" running style will not allow you to run at your best. Running fast (whether a world record or personal best) demands an intensive, concentrated, powerful effort. Breathing as described assists in the physiology of circulation and gaseous exchange.

Let us now take a closer look at correct arm action, firstly by examining examples of poor technique. There are many runners who throw their arms across the body in great sweeping arcs. The result is that the legs swing in wide arcs also, and the runner wastes a lot of energy going from side to side, instead of straight ahead. Leg injuries can result from running in this manner, as it puts a great deal of strain on the knee and hip joints, which are not designed to support a side-to-side and twisting action. Then there are runners who take the arms along for the ride, carrying them uselessly at their side. The result of not using the arms effectively is very slow speed, and an excessive amount of stress put on the legs and mid-section of the body. A "stitch" is often the result of a jerky, twisting motion of the upper body, and stomach muscles trying to balance the powerful leg activity. The job the arms have to do! Back troubles leading to hamstring problems are another result of this "no arms" body twisting.

The hands should swing up and across the body (remember the acute angle of the elbow), not quite reaching the centre line of the chest. When you have this arm action mastered it

will cause your footprints to follow a straight line. This type of arm action will make the feet swing in slightly, and the foot land naturally on the extreme outside edge of the ball of the foot. God designed the human foot to work in this way, with a nicely rounded heel, so that the foot can roll gently inwards as it takes and carries the full weight of the body. An arm action which is too wide and sweeping, or is in any way haphazard, will make it impossible for the feet and arms to work in harmony.

In proper running technique, therefore, the foot should land on its outer front perimeter, such that the footprint follows a straight line. As the weight is borne by the foot, it rolls inwards until flat on the ground. If you run incorrectly, for example by throwing the arms out wide to the sides and all over the place instead of pulling the fist and forearm in and across the body, the legs will also fly out wide of the straight line track of correct running. This makes two distinct lines of footprints, with one for the left foot and the other for the right foot. As a result, the feet will not strike the ground on their outer perimeter, and in the worst case may even land on their inner perimeter. In the latter case, the foot will roll outwards and the shoes will become worn out and collapse on the inner side of the soles. This is what the shoe manufacturers try to counteract by putting all sorts of boot-like structures on the heels of their shoes. If you correct your running technique, however, your shoes should wear properly without such alterations being necessary.

Remember that the arms and fists are punched high and a little across the body, and towards the centre of the chest. The other important factor in proper arm carriage is the position of the elbow when the arm swings back behind the body, with the hand at the side of the ribs. The most effective position is achieved by a closing of the angle of the elbow - a sharpening of the elbow position and a simultaneous controlled, tidy hand location - close to the side of the lower ribs. This is in contradiction to articles I have read in various running magazines. They say that you should throw your hand down, back, and away from the body. You see this exhibited by many runners. One of the worst examples is Lorraine Moller of New Zealand. It is interesting to watch what happens to these loose-armed runners in a tight race. When Moller ran in the Los Angeles Olympic Marathon, she and the rest of the runners were following Joan Benoit up to about 20km. At this point, Rosa Mota and Grete Waitz piled on the pace with their compact and efficient running styles, but Moller could not respond, as her inefficient arm flopping actually prevented her from quickening her pace. Her arms absorbed energy from her legs, instead of adding to the force she was able to generate, and in the space of only two or three kilometres, Moller was left so far behind that she was out of sight on my video film. Moller has been advised by a school of coaching which says: "It doesn't matter how you run, especially with your arms. All you have to do is relax them" - even if this means dangling the arms. This is rubbish. Anne Audain has also degenerated to this arm flopping and dangling technique, and by a remarkable coincidence was also decimated in the Los Angeles marathon after about 20km.

We see sprinters getting away with murder in the 100 metres as far as good arm technique is concerned, and even some of the best sprinters run with bad errors in arm technique. As they go up in distance, however, this "sorts out" many of the bad runners, and they get increasingly injured especially when negotiating bends. Even the 400- and 800-metre events see sloppy runners, but in a Marathon such runners only stay in the lead for a short time, if at all, with the increasing distance eliminating them one by one, until the finish brings the cream to the top.

The ruling principles in correct running technique, therefore, are power and efficiency. It takes endless hours of practice to get it right, and it may be necessary at first to spend several days or weeks practising in bare feet in a nice, safe place such as a running track

or strip of smooth grass. Take the development of proper style one step at a time. Be patient. There is no need to move on until you have mastered the skill you are working on. As you develop, continue to keep the skills you have already mastered clearly in mind. It may be helpful to work with a partner or in a small group so that you can help each other as you go along. A knowledgeable coach is the greatest asset a runner can have.

After you have correct technique mastered, you can then move on to a training programme which will allow you to meet your goals safely, efficiently, and without injuries.

What About Shoes?

Now that we know something about correct technique, let us consider in more detail the type of shoes which will be of greatest benefit, and how to make them from the garbage produced by most shoe manufacturers.

In bare feet, Abebe Bikela won the 1960 Olympic Marathon over the terrible streets of Rome on a course that included stretches of cobblestones. Bruce Tulloh won the 1962 European 5,000-metre championship in his bare feet, running the last three laps in just over three minutes. Similarly, in bare feet, teenager Zola Budd set world records over 2,000 and 5,000 metres, world junior records at 1,500 and 3,000 metres, and ran one mile in 4:17.55; she was also barefoot when she won the 1985 World Cross Country Championships.

Look closely at the footwear worn in major championship events, and you won't see anyone competing in anything except the very lightest racing spikes. No-one in the Olympic Games or World Championships races in the overstuffed, wedge-heeled orthopaedic boots that most joggers wear. This is not surprising, as the difference between running in barefeet and in the typical jogging shoe can be up to 30 seconds a mile, and I therefore advise all my trainees to wear the very lightest shoes they can find for training. These shoes should have the same amount of padding at the front under the toes as at the rear, with no wedged or flared heels. It is essential that the material under the toes of the foot be at least as thick as anywhere else in the sole, because 90 percent of the wear takes place under the toes when correct technique is employed.

Unfortunately, the ideal running shoe is not offered by most major manufacturers. Your best hope is to get the lightest, most economically constructed shoes you can find, then machine them to the correct specifications. The perfect running shoe should be something like a heavy-duty ballet slipper - simply an extra layer of protective material around the foot, like a glove. If you run correctly, you will be able to wear such a shoe and never be injured. I once advised a 58-year-old marathon runner, Ed Schaeffer, whose best time had been 3:28, to change his technique and shoes, with the result that his time immediately dropped to 2:58. He told me later it had been "easy" to run 30 minutes faster! Another example was a 4:12.8 miler I retrained; he dropped his time to 4:02 in just three weeks.

Now that you know what to do with your feet and legs, and understand how poorly designed running shoes contribute to both injury and slower running, how may we produce a shoe to fit your feet?

We shall do this by taking a typical pair of running shoes, and reconstructing them to the correct specifications. Firstly, the shoe should fit properly; the foot will slip and slide in a shoe that is not close-fitting, resulting in a loss of performance as well as friction-related injuries such as blisters, which can lead to subtle changes in the way you run, and predispose to more serious injuries. Ideally, the shoe should fit snugly "like a glove".

Secondly, it is essential to prevent the most common injury directly related to poor shoe design, namely that to the Achilles tendon. A very quick way to guarantee yourself an injury to this very vulnerable part of your body is to allow any part of your shoe to impinge on the tendon - all running shoes have a piece of material (either plastic or leather) that jams into the tendon when the foot is plantar-flexed (i.e. the toe is pointed down). Clearly, if you run many miles, you will put a great deal of jabbing pressure on the soft Achilles tendon on every step, mile after mile. With an Achilles "protector" on your shoe, discomfort or injury is guaranteed. The quickest remedy to this problem is to take a knife to the curved piece of shoe material and cut it off, so that the top of the shoe heel is level with the rest of the upper, and below the level of the soft tissue of the Achilles tendon. The top of the shoe heel must not be higher than the bony heel. Runners who come to me limping with very sore Achilles tendons are able to run away with their pain relieved after this surgery is performed on the shoe (with the shoe removed, of course). This "operation" will make the shoe about half a size larger than it was originally, so bear this in mind when purchasing shoes. Thus, if you buy your shoes a bit snug and remove the heel tag before you wear them, Achilles tendon problems should become a thing of the past.

Another problem related to shoe design is the shape of the inside of the heel of the typical running shoe, which is different from that of the normal human heel, such that it only contacts the top of the heel bone. As a result, there is too much empty space around the base of the heel bone. This space needs to be filled in to provide a close fit around the entire heel. If left unfilled, the upper portion of the heel bone will receive excessive pressure because the shoe presses on the foot only on an area directly below the junction of the Achilles tendon with the heel bone. The result is severe blistering in the short term, and heel spurs and Achilles tendonitis in the long term. To make the shoe conform to the shape of your heel, fill in the space with surgical padding, being very careful to ensure that the padding conforms exactly to the shape of your heel.

Clearly, this should be the job of the shoe manufacturers, and I discussed this problem with Adi Dassler, the late founder of Adidas, as early as 1959. He agreed with my evaluation of the shape of running shoe heels (but, sadly, I still find it necessary to customise Adidas shoes).

To summarise, therefore, friction interference of running shoes with the soft tissue of the Achilles tendon and bursae of the heel bone/Achilles tendon junction causes injury. Consequently, all parts of the shoe that impinge on this area should be removed.

Contrary to what the shoe companies would have you believe, the foot is supposed to twist and roll as it goes through each contact phase with the ground, and yet they continue to come up with new ways to prevent the foot from moving in this way. The amount of movement varies from person to person, and depends on the strength and development of the intrinsic muscles of the foot and foreleg, and whether you land correctly with each foot. Putting all sorts of excess materials and supposed clever ideas into running shoes (i.e. soles and uppers) has practically nothing to do with these foot movements. When the shoe is on the ground, it becomes a part of the ground and the foot does its necessary rolling and twisting within the shoe. If a shoe is made to become a straight jacket to prevent the natural movement of the foot - for example a ski boot, or a stiff rubber gumboot - you cannot run, you hobble. You will only be able to carry out part of the physical movements, and apply only a fraction of the physical forces, that are essential to drive yourself forward at a fast running pace. This is easy to prove - go out and run in bare feet, then start adding material onto your feet. You will slow down.

The same applies to shoes which interfere with the undersurface of the foot. Any change in the curvature of the sole of the foot caused by a shoe - for example, nylon pylons across the sole at the rear of the ball of the foot, lifted nylon rings around the spikes, and lumpy soles caused by the cut-away under the toes of most jogger's shoes (thus presenting a ridge under the padded ball of the foot) - will interfere with your ability to run. The rolled up toes common to most jogging shoes are the cause of the sharp pains in and around the joints between the toes and the metatarsals familiar to most runners. Any departure from the natural shape of the foot will interfere with your ability to run, and lead to injury.

The current infatuation with exotic running shoe design has not always been in effect. When I began running back in 1939, everybody used a "plimsoll" - the English name for a very light canvas tennis shoe, which could be bought from Woolworth's for just a few pennies. Most of the running we did in those days was through the woods and over the downs - those rolling hills so typical of the English countryside. The North Downs Escarpment in Surrey, where a great deal of our training was done, is particularly steep and rugged. There are footpaths through the woods and fields, and the going is beautiful, with reasonable green grass in the spring and summer, and lovely mud in the winter. The woods and fields are interlaced with miles of hedge-lined country lanes, barely wide enough for two cars to pass. The surface of these old roads is not particularly hard, and is smooth and firm. The countryside around our home at Coulsdon stretched out for miles like this in every direction. Access from our street was straight up a 250-foot hill at a gradient of about one in three. Every run we did started up that hill outside our front door - flat-out (with no stretching exercises!).

Our school races from Purley County Grammar School - which is situated on top of one of those rugged hills - started with a three-quarter mile descent, then rose sharply up another hill to the top of the Downs, levelling off for about half a mile along the summit, before descending again into the valley. These races finished with another stiff climb back to the school. We became very skilled at streaking down and smashing up any hill with enough energy left to sprint away at the top. Our "sand shoes", "plimsolls", "tennis shoes" - call them what you will - were superb and injury-free equipment.

In later years I got hold of a pair of hand-made leather "G.T. Law" cross country shoes with steel spikes in the soles. They were excellent for cross country racing, but it was not a good idea to run on country lanes with them. Leather shoes like those cost a lot of money, and were something of a luxury. I wore away the steel spikes of this particular pair, and repaired them myself with sail maker's gear - a hard leather thimble and a large needle - replacing the sole after putting new steel spikes in place. Even though I worked at keeping these shoes together, they did not last long enough; not because my skills as a cobbler were particularly lacking, but simply because I ran too many miles in those fine shoes.

Most of the time we trained in our plimsolls. The plimsolls were smooth-soled, so we had to concentrate very hard on staying on our feet when running on slick or muddy ground. We became very strong as a result. The constant hill running, the mud and the smooth-soled shoes meant that we *had* to develop efficient technique!

Cross country racing in England has always been a very tough game. It has absolutely nothing in common with what passes for cross country in the US and in World Cross Country Championships. The courses we ran traversed newly-ploughed fields, swampy areas and very tough hills. The runners had to be strong to run on these courses, which covered distances of up to 10 miles. These races sorted out the men from the boys in a hurry! I believe this tough style of cross country running is a major reason why the British

have had so many great runners. The cross country season runs from September to March in England, which is not exactly the dry season, so shoes are very important. I began running with very little appreciation of just how large a part shoes play in an athlete's success, but discovered the hard way that if you wear the wrong shoes, you cannot perform at your best, and you will be beaten.

One year I used a pair of "studded" hockey shoes that were constructed in a similar fashion to high-topped basketball shoes. It was necessary to cut off all the extra ankle material to make them flexible enough for running. Another type of shoe I tried was a Canadian-made cushion-soled basketball shoe. These shoes were extremely comfortable, which is why I chose them! However, in hindsight, that was no criterion for judging the suitability of a running shoe. I ran a cross country race of five miles in those shoes, which was a serious mistake. The rest of the field, including my brother Peter, were usually easy to beat by a minute. But with those boots on my feet, they kept up with me. I learned that these heavy-soled "boots" were useless for racing unless I wanted to lose. They were a lot like the orthopaedic running boots most joggers wear today. I did not make the same mistake of wearing those shoes in a race again. Since then, I have learned that even training in shoes like that damages a runner's skill so much that you cannot race effectively. They cause an athlete to run incorrectly, develop improper technique, and become injured.

I had my first pair of track-racing spikes made to measure by Law's of London in 1948. They were much lighter than my other cross country shoes. I raced in them until after the 1952 Helsinki Olympic Games. I think I lost a medal in those Games because the spikes in this particular pair of shoes had been worn down from their normal length of 10mm to less than 2mm, rendering them useless - though I was supremely ignorant of that at the time (I came fourth). I think that I might have been in contention in that 5,000-metre race when the sprint started if those shoes had had any steel left in them to grip the track. Their leather soles were scored with long abrasions as the toes of my feet dug away at the cinder track, slipping at every step.

So much for my early ignorance of the importance of proper shoes. Today, I am very particular about the shoes worn by the athletes I train. I teach all my runners to train in the lightest shoes they can find. Anne Audain told a mutual friend in 1982: "Well, at least one good thing Gordon Pirie taught me was to wear lightweight shoes". In recent times, Anne has run in heavier shoes; and has had a good dose of injury as a result.

In the 1952 Olympics, Bronze Medalist Herbert Schade of West Germany wore a pair of red shoes that caught everyone's eye. The colour was very unusual because all running shoes then were made of black or brown leather. Through Schade at Helsinki, I met Dassler, a stocky, genial man who was never without a cigar in his mouth. He was the man who had made Schade's red shoes, and he offered to give me a pair. Nobody in England had offered me such help. This was a very welcome development, because I had been making my badly worn shoes work for over two years, even after they had become useless.

This brief episode began the "Pirie-Adidas connection", an association that has lasted for well over 30 years. I have run with Adidas shoes since that first meeting with Dassler, and have found them better than most other brands. From time to time, I lived at Adi Dassler's home, and worked closely with him at the Adidas factory bench in Herzogenaurach. It was we who designed the present day track spike layout in Adidas track shoes. Prior to this time, Adidas track shoes had had a large spiked area well back under the arch of the foot. These rear spikes were not necessary and got in the way. I told

Adi to get rid of them. He did. Today, with most track racing done on rubberised surfaces, the track spike layout needs to be changed once again.....

Dassler used many of my ideas when he redesigned his running shoes during the 1950s. The wedged sole for what became the Adidas "Interval" shoe was our design, and was first constructed right there at the Adidas factory bench for Shirley Pirie to sprint in. Today, Adidas has become a huge conglomerate, and no-one seems to be able to get a good idea into its impregnable corporate machinery. The type of close work I did with Adi Dassler has become impossible, and shoe designs have suffered accordingly.

To test the shoes we designed, I ran hundreds of miles in each pair and wrote a log of the mileage on each shoe. I then posted the shoes back to Adi so improvements could be worked out. The biggest breakthrough we made was to find the answer to the problem of worn steel spikes, which had cost me a better result at Helsinki. All racing shoes in those days had fixed spikes. Once the steel had been ground away by the cinders, which I managed to do in about 200 miles of hard running over a week or two, the shoes had to be discarded, even though the upper might still be perfectly good. I discussed this problem with Dassler, and asked why the shoes didn't have steel spikes that could be replaced. I was throwing away shoes by the dozen. The answer was surprising simple: we came up with the idea of screwing the spikes in and out of the shoes so that the steel could be replaced, and, even better, changed to suit different track surfaces. Because Dassler was willing to work closely with an athlete like me to improve the design of his shoes, his company became the first to come out with track shoes with replaceable spikes. Ironically, I nearly lost my amateur status at that time because every box of Adidas shoes contained a picture of me running a world record in Adi Dassler's bright red track shoes! (Although I never made any money out of this - a fact that seems incredible in comparison with today's hyper-commercial world).

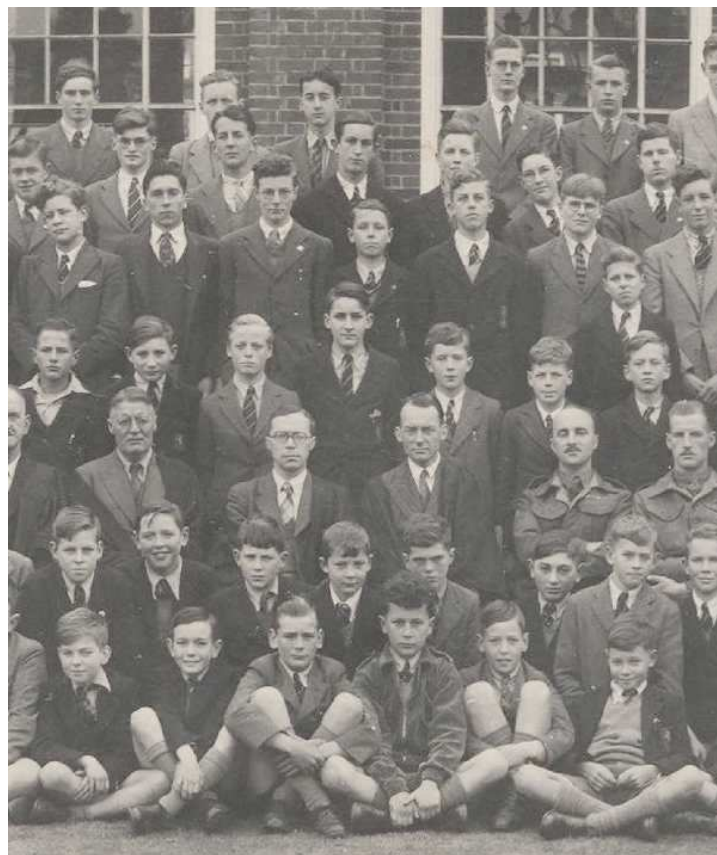
I had a difficult time getting Adidas shoes introduced into England. I tried initially in 1953 and 1954 to have the shoes sold in English sports shops, but failed. I took a pair of Adidas shoes into one famous Lower Regent Street shop, Lillywhites, and was told by the buyer there that: "These things will never sell!".

In recent years, I have had ideas about running shoes which are just as revolutionary as those pursued with Adi Dassler in the 1950s, but my ideas are just too radical and advanced for Adidas. Sadly, Adi died a few years ago, and his huge corporation has become completely divorced from the grass roots of the sport. For example, I had a meeting with Horst Dassler (who took over the management of Adidas some time ago), at which I told him I thought that certain Adidas shoes were being constructed according to improper ideas. His answer was that the company had spent a large sum of money on a "motion study" of runners before designing that particular pair of shoes. I laughed, and told him that he could have paid me half that amount, and I would have come up with a better design. I told Horst Dassler that Adidas obtained flawed results in their expensive study because the runners they examined were not running properly. Sadly, he ignored my suggestions, and it seems that running shoes have become little more than an injury-producing, speed-reducing fashion statement.

Finally, I have two brief observations to make concerning the materials with which running shoes are constructed. Firstly, if you are running correctly your shoes will wear out initially at a point directly under your toes. You can prove this by taking off your shoes and going for a short run (on a safe surface, of course) in bare feet. Very quickly you will find you develop blisters on your toes. If you run correctly, the same thing will happen to your shoes; they will wear out under the toes. I can wear out a pair of standard jogging shoes, made with a thin layer of material rolled up under the toe, in just one long

hard run on abrasive pavement. It is very important, therefore, for the toe area of your running shoes to be constructed of the toughest possible material, and to be of adequate thickness.

The second point concerns the material that makes up the sole of your shoe, because if the sole is too soft, you will lose stability. Any soft, mushy material between your foot and the ground will decrease the amount of stability the shoe provides, and will also absorb much of the power you should be using to run with (try running on a trampoline or a high jump pad; it is simply not possible). Buy shoes that are not too soft, therefore, and do not under any circumstances put anything soft inside your shoes. You will defeat the purpose of buying a firm, lightweight shoe in the first place. Instead of looking for padding, learn to run properly, so that you stop punching holes in the ground with your feet.



Purley, 1946 (can you spot Gordon?)

CHAPTER FOUR - TRAINING

In this chapter, we will examine the specifics of how to prepare yourself to compete over the full range of racing distances - from 100 metres up to the marathon. The specifics of training for each group of distances may be different, but the basic principles remain the same, regardless of whether the athlete's race lasts a few seconds or for several hours. The goal of training is to prepare the body to cover a particular distance as quickly as possible. The key to a sound training programme is understanding what is required in order to accomplish that goal.

How To Run A Race

The purpose of training is, of course, to race over your speciality as quickly as possible. In order to understand exactly how to go about training for a race, we must first know what a race is and how to run it.

If you came from outer space, knew nothing at all about running, and I challenged you to a race, how would you go about preparing? Let us say that you have a month to get ready. I have shown you the starting and finishing lines. It is irrelevant what the distance is - you, the Spaceman, have no concept of Earth distances anyway. The answer to my question as to how to train is to stand at the start and run to the finish line as fast as you can. Then you will take a rest, and do it again and again until you have become good at it. On the day of the race, our Spaceman will set off as fast as possible in an attempt to get away from his competitors. He knows from his training what pace he can endure. He knows that if it is difficult for him, it is likely to be difficult for the others, too. The harder he runs, the greater his chances of defeating the others. If another runner hangs on to him, he knows that he either has the other runner at his mercy, because this fellow is hanging on, or, alternatively, the other runner is dangerous because he is attempting to pass and take over the pace himself. If it is a "hanger on" situation the Spaceman will attack, and accelerate in an effort to detach himself. If, on the other hand, it is a "cheeky challenger", the tactics must be different. Let him take the lead for a spell. If the fellow is strong, you must keep up at all costs. Keep up and gather yourself for a finishing sprint. This is the hard part. You must wait and be very alert, for your competitor is going to do the same thing. You have to strike first to get a lead of a few feet or yards, you hope, before he himself attacks. If the other runner gets his sprint in first, you must go with him instantly, striving to wear him down and finally pass him in the last few yards.

Thus, in a race, one must never give a competitor an advantage. A good example of this happening occurred in the World Record Mile of 1985, in which Sebastian Coe allowed Steve Cram to steal a considerable lead in the second lap. Coe then used up his reserves to catch up again in the third lap, and as a result lost the capacity for his legs to sprint, and hence the race. You have to keep in contact with your closest challengers the whole of the distance, Mr Coe!

Interval Training

Let us now look at the fundamentals of Gerschler's classic Interval Training Protocol, in the hope of shedding some light on this clouded subject; and in the process do away with the myths that have grown up around it.

Gerschler's system embraces all distances from 2,000 metres down to 100 metres. His statement that you can achieve full development in winter training through the use of only the three distances of 100, 200 and 400 metres has led to the popular misconception that Gerschler and his champions only trained in this way. Wrong! Even Rudolf Harbig, World Record Holder for 400 and 800 metres, ran stretches of 2,000 metres in his preparations for races. This is a typical training day taken from Harbig's Diary:

40 mins easy running; 1x2,000m; 20mins jog; 2x1,000m; 12mins jog; 2x600m; 12mins jog; 2x300m; 8mins jog; 1x200m; 6mins jog; 1x100m; 10mins jog.

Interval running, properly applied, is not only scientifically sound, but is also the most efficient and quickest way to bring an athlete up to a high standard. Improperly applied interval training has led to this time-honoured and well-proven system being maligned and blamed for athletes experiencing all kinds of difficulties. This is because careless application of interval running can damage runners. On the other hand, when it is applied intelligently, its results can be nothing short of miraculous. The plain truth about interval running is that it serves the purpose of developing the heart, circulation and muscles better than any other system. Its beauty is that it does so in a fraction of the time required by long slow distance (LSD) training.

The longer stretches of race distance together with middle distance are an indispensable part of Gerschler's system, which is now well over half a century old. It preceded all other such systems of training, and it should be appreciated that Gerschler was the forerunner of a long line of experts who have put forward his ideas as theirs.

Much of the difficulty many athletes have with interval training is that they approach it like a competition. Gerschler's motto for interval running was: "Take it easy". As I started my faster runs in an interval session, he always called to me: "Langersammer (Slower)!". You should take an interval session in your stride, running well within your capabilities. We cruised around the faster sections of our runs with controlled power. As a result, even after 80x200 metres I was still able to go for a run around the forest in Freiburg for another 3 miles or so, and then be ready for more later in the day. It was a very enjoyable way of running, but involved a lot of sweat!

The following factors should be carefully controlled in an interval session:

1. **Speed.** The pace should be such that the athlete is able to complete the whole session without undue difficulty.
2. **Distance.** The distance run in this type of training should not be longer than the athlete can comfortably achieve at the required pace.
3. **Repetitions.** The athlete should not be expected to repeat a distance during a training session more often than he is comfortably able to do.
4. **Continuous motion.** The athlete should run at a comfortable pace between fast runs to assist in the recovery process.
5. **Variation.** Distances and speeds should be varied from session to session to maintain interest.

6. **Technique.** Training sessions should provide the coach with an excellent opportunity to monitor his athlete's technique.

During an interval session, a given fast stretch should be run at least 10 times, with the interval between runs being determined by the time required for the athlete to recover physiologically. This can be calculated by monitoring the athlete's pulse rate during the recovery interval. The aim is to run with sufficient speed to stimulate a highest pulse at the end of the fast stretch of 180 beats per minute; that is, 18 beats in 6 seconds. Recovery at this top end of the heart's effort occurs so rapidly that the best way to count the pulse rate is electronically. Failing this, measure the pulse rate at the wrist, on the left breast, or on the carotid artery (one only!), using the fingertips. An actual 180 maximum heart rate may be indicated by a 17 count in the first 6 seconds, because of the rapid initial drop of heart rate.

The interval should be run at a continuous trot, and with the same rhythm that is used in the fast run; the breathing rhythm should also be identical. This assists greatly in the recovery process. The interval's length is again decided by the heart's behaviour. When the heart rate has fallen to 120 beats per minute - 12 beats in 6 seconds - the recovery is complete and the next fast stretch can be run. As one might expect, the interval after the first few fast sections will initially be short, and then progressively lengthen to a standard interval as the heart takes on the full workload of the training session. A typical workout, say 20x200 metres, might see a set of intervals as follows (for a particular athlete at one stage of his development):

No.1 x 200m : 25 secs interval.

No.2 x 200m : 35 secs interval.

No.3 x 200m : 45 secs interval.

No.4 x 200m : 55 secs interval.

The next 14x200m run might require a standard interval of 60 seconds. As fatigue sets in after this, and the "rest" interval required extends to 65 seconds, **stop running!**

Progress is indicated by an improvement in the required rest interval (i.e. it gets shorter), and also by an increase in the number of repetitions which can be run before the onset of fatigue. In addition, progress should be accompanied by an ability to run the fast section at a greater speed without breaking the top pulse rule (i.e. keeping the maximum pulse rate below 180 per minute), which should occur with ease, and without extra effort.

The usual times taken to run 100 metres vary from 20 seconds for the beginner down to 15 seconds for the highly trained athlete. The equivalent figures for 200 metres are 40 and 30 seconds, and for 400 metres 80 and 60 seconds, respectively.

The number of repetitions which can be run varies from 10 up to as many as 40. Even more can be handled by a world record runner. Before the latter state is reached, however, it will be time to progress to other types of training (described later).

Interestingly, during interval training, most development occurs during the interval; this was the conclusion reached by Waldemar Gerschler and Professor Reindel at the Freiburg Sports Institute after many years of research on thousands of subjects. Consider this quote from an article by Gerschler himself, which appeared over thirty years ago in the magazine "World Sports":

"Tips From The Tutors

HEY, NOT SO FAST!

Athletes are often uncertain about what distances they should cover in training, and how fast and how often they should run them. Again and again, THEY TEND TO GO TOO FAST IN TRAINING, especially at shorter distances (writes Waldemar Gerschler).

Winter training can be arranged simply yet effectively if two distances are concentrated on - 100 and 200 metres - with jogged intervals between them.

A sprinter capable of running 100m inside 11 secs might reasonably take 12-13 secs for his training runs. A 400m man under 50 secs might cover 100m in 14-15 secs; the 800m man under 1:53 and a 1,500m runner under 3:50 in 14-15 secs; the longer distance runner inside 14:30 or 10,000m inside 31 mins in 16-17 secs. The jogged interval 100m should take 30 secs if the athlete is highly trained, 45 secs if in the intermediate stage and 60 secs if he is a beginner.

These times may seem quite modest but from the training angle they are rather fast - in fact I am sure many will need to make them more modest still. The time of the run is of only secondary importance; more important is the timing of the intervals, and it is vital to adhere to these.

At the beginning of an athlete's training his effort should not be forced; growing fatigue indicates it is time to stop. But after three or four months a good athlete who has been training four or five times a week should cope easily with 40 repetitions. (The sprinter should not aim at 40 repetitions; about 20 will be better for him).

For training at 200 metres, the sprinter might run that distance in 25-26 secs, the quarter miler in 28-30 secs, 800 and 1,500m men in about 30 secs, and long distance runners in 33-34 secs. The intervals between repetitions will, like those for the 100m training, depend on the athlete's ability: if in the intermediate stage, 60 secs; if a beginner, 75 secs. After three or four months, 40 repetitions should be reached.

Cross-country running in the winter provides good training, but the sprinter should not participate. It should be remembered that the athlete himself can find what suits him best, by personal experience and observation.

An athlete not being trained by a coach should set himself a long term target. For instance, a middle distance runner over 20 years of age may say to himself that after three or four months of winter training he will (what a significant word, that "will"!) run 40x200m in 29-30 secs without looking particularly strained. Between each 200m he will jog for 60 secs. If he has been building up over a considerable period of time, say four to five years, he can aim at reducing his jogged interval to 45 secs.

Two other sessions he might do are 40x100m in 14.5 secs (or 15 or 16 secs, to be decided by an expert), with a jogged interval of 30 secs, and 30x400m in 70 (or 72) secs, with a jogged interval of 60 (75 or 90) secs.

And, finally, remember that strength is vital in sport. If you think you are insufficiently strong in, say, the chest, arms and legs, train with weights."

Bearing in mind the above quote from Gerschler, here is how to put together a training session which effectively employs interval training. Begin with gentle activity. Since your last training session your body has no doubt drifted into a lazy state. You may be apprehensive about training because you go too hard at it.

Begin by relaxing your mind; go slowly. Even walk to start off with, then run easily but with a quick rhythm, for about 20 minutes. Most athletes do not warm-up enough. If possible, do this warm-up away from the track; in a park, woodland, or anywhere where you can concentrate on your technique and breathing. Never step straight out from cold

and do those silly stretching exercises. Don't do static stretching at all; this is associated with injuries. Always run easily for 10 to 15 minutes before any exercises. Then do 5 minutes of exercises, which should mainly be free movements, imitating the actions of running. These involve a fairly large range of movement, so will allow you to run more freely.

Now you are ready to start the interval running itself. Change into racing shoes. If the session calls for 200m in 32 secs, start easily with, say, 38 secs, using the first few to work down to the required time. The times should go about: 38, 36, 34, 33, and, finally, 32 secs. If you have never done this kind of training before, you will have to establish the interval that is appropriate for your physical condition. Lie down for the intervals and count your pulse as described earlier. The first few rests will be short, but should settle down to a steady length. The pulse rate might be: 17, 17, 16, 16, 16, 15, 15, 15, 15, 14, 14, 14, 13, 13, 13, 12, for the 6 second groups, making a total time for full recovery of 80 seconds. Note that a jogging interval will be longer, by about 10 seconds. Now you can transfer to a jogging interval of 90 seconds, checking the intervals every 5th one. When the standard resting time lengthens beyond 90 seconds, STOP RUNNING. Coincidentally, your body will also tell you to stop at about this point, as you will probably experience extra fatigue.

Note that the maximum pulse rate you will be able to count is only about 170 beats per minute, because the heart rate quickly decreases below these high levels. If you have an electronic pulse monitor, however, you may catch these top pulse levels during the last moments of running hard. If you do count 18 beats in the 6-second measurement periods, slow down your fast run so that the first count is only 17 beats in 6 seconds.

Control the interval at all times by reference to the stopwatch, and not the distance run. Thus, for example, beginners may only need to run 100 metres to raise their pulse to the required level of 180 beats per minute; some may need to run no faster than 20 seconds for their 100-metre repetitions to do this.

Your development can readily be assessed by analysing the changing parameters of your interval training over a period of time. As you progress, you will find that the rest your heart needs between each hard run will shorten dramatically, the number of repetitions (reps) that can be managed easily will increase, and the actual distance you will be able to cover will extend from the starting distance of 100 metres to 200m, 400m and so forth, as laid down in Gerschler's "World Sports" article.

It therefore follows that as you get fitter, the interval sessions will get easier in every way, and you will be able to spend less and less time at your training!

I have run crazy interval sessions, though today I do not think that they were necessary in such prodigious amounts. Here are some examples of those sessions:

100 x 100m 15 secs, jog 20 secs.
80 x 200m 29 secs, jog 30 secs.
54 x 400m 64 secs, jog 45 secs.

These training protocols were complemented by doing a one-hour warm-up, and 20 minutes of easy running afterwards. Some sessions embraced a total running time of over three and a half hours.

Today, however, after years of experience with the interval training technique, we know that it is sufficient to work up to a point where you can run 10 to 20 x 400m in around 60 seconds, with an interval of 25 to 30 seconds. When you reach this point, you are then ready to move on to greater things, and a conversion takes place from interval training to

preparation for racing. Racing requires short periods of higher speeds and/or continuous speeds plus "high speed", in order to enable you to win races at the finish.

At this stage of training, you should start race simulation, and fast and hyper-fast training, interspersed from time to time with a session of interval running (but not too close to a race). Race simulation involves the following:

- 1 - Run stretches in which you race hard all the way over 30 to 40 minutes.
- 2 - Run the race distance hard.
- 3 - Run the race speed as far as you can, and repeat it.

These activities should come together over a period of about 6 weeks. For example, a 5,000m runner attempting to run 14 minutes may try to run 68 seconds per lap all the way. This speed will be adequate because the "average" time will be upgraded by a fast final lap. He therefore must practice 68 seconds per lap for the greatest distance he dares and can manage. The next step would be for him to run 14 minutes hard to accustom himself to the duration of the race effort, and then to run 5,000m time trials on the track. Time trials are an indispensable part of training. At the beginning of the season (first time trial), one usually manages to cope with 2 or 3 laps before losing speed and coming apart in every way. On the second time trial, I usually find I have improved, and manage five or six laps before crashing. After half a dozen trials, my psychological attitude has reached the stage where I am thinking: "There's only 12 laps left, lets go! Speed up! Speed up!" instead of struggling negatively to finish the run. My legs "Speed up!" to run like a well-oiled machine, instead of negatively struggling. Most runners never reach this stage of pure attack even in racing, either because they become discouraged during their early time trials, or because they haven't done any! Despite running world records, I had to go through this psychological and physiological phase at the beginning of every racing season - and so must you. You must cope with this if you want to win. You must build up your mind along with your body. You forget what hard effort was required last year in order to run super-fast times now.

Keep the notion of continuous motion in mind at all times. Interval training on its own can overtake and even destroy you. It is important to fully utilise all elements of a balanced training programme - interval training, longer stretches, general running and strength training - throughout the year, but to change the emphasis as your condition improves and your racing season approaches. Keep off the energy-absorbing intervals - this is where most athletes make their biggest mistake. As an athlete gets super-fit, the coach makes him run more and more sessions of 200- and 400-metre repetitions in hyper-fast times with shorter and shorter rest intervals. It certainly looks good in the training reports, but doing this sort of training will quickly turn a champ into a chump. Interval training is very destructive unless Gerschler's rules are adhered to.

Thus, take it easy with proper speeds, proper running rest intervals and proper distances. Where high racing speeds are desired, hyper-fast runs are needed, to be followed by a generous period of passive recovery (even as much as 20 minutes). Note that this is not interval running, and a different set of rules apply. An example of this type of training protocol would be:

- 400m (down to 50.0), rest 20 mins, repeat 4-8 times.
- 600m (down to 1:14), rest 20 mins, repeat 4-8 times.

800m (down to 1:50), rest 20 mins, repeat 4-8 times.
1,000m (down to 2:28), rest 20 mins, repeat 4-8 times.
1,200m (down to 2:50), rest 20 mins, repeat 2-6 times.
2,000m (down to 4:58), rest 20 mins, repeat 2-3 times.

The number of fast runs performed is inversely proportional to speed. Thus, the faster you go, the fewer such runs you will be able to manage. In ideal weather conditions, the rests should be passive (stationary) rest, and not running, followed by a mini-warm-up (e.g. one lap of jogging containing three or four accelerations over 10 to 15 metres). Following this, walk around for a minute or two gathering yourself for the fast run.

In order to deal with this type of faster training, we need to add some introductory speedwork to your warm-up. After the easy running and exercises, put on your spiked shoes and run 6x100 metres, beginning lightly and working up to the speed you will employ during your hyper-fast runs (e.g. 16, 15.7, 15.3, 14.9, 14.5, and 14.0 seconds per 100 metres). Between these easy warm-up sprints, jog-walk back to the start line. It is important to measure these speeds carefully because you are trying to develop fine judgement of the exact pace you will utilise in the fast time trials. A feeling of good rhythm and correct effort, plus proper technique, are all reinforced during this introductory warm-up "speed" running.

During your hyper-fast runs you will need to be given appropriate intermediate times, so that you can further develop sound pace judgement. For example, an athlete attempting to run 400 metres in 50 seconds should pass 100 metres in 12.8, 200 metres in 24.5, and 300 metres in 37 seconds. Note that the first 100 metres of each repetition should be slightly slower than the rest of the run (having started from zero speed in the first 100m), so that the athlete is able to finish strongly and fast without an undue feeling of fatigue and loss of form; as experienced in badly judged efforts (e.g. 11 secs, 11.5 secs, 12.75 secs and 14.25 secs, which is devastating physically and psychologically, and not beneficial at all). In addition to the above, Gerschler taught us to run hard to at least 10 metres beyond the actual finish line. Gerschler was concerned how we drove through the tape in a race. He had nightmares (almost!) seeing Josey Barthel racing the last few steps, looking pleased and slowing up while winning the 1,500m Gold Medal in the Helsinki Olympics - nearly letting Bob McMillen of the USA through to win. So we always trained to run beyond the tape, and not at it!

Training is much more than just running intervals. You must go on to do race practice, together with fast and hyper-fast running. The hyper-fast times shown above are for a world-class athlete in peak form; you will therefore have to adjust your expectations accordingly. For example:

1 - 400m to be run in 60 secs, then 58 etc. down to 52 or even 48 secs over a period of time.

2 - 600m in 1:36, then 1:32, then 1:30, then 1:28, and perhaps even 1:14.

3 - 800m in 2:04, then 1:58, then 1:54, and perhaps even 1:48.

(N.B. Each training session should produce identical times for each run. The improvements quoted occur over a period of time).

The variations possible in this type of training are infinite. Training becomes a very interesting game of combining all these various elements into your programme in the proper amounts at the proper times. Early in the year, you should be doing a great deal of general running in the forest, including a lot of hills. As you get fitter and fitter, you can then add interval training to your programme, and then hyper-fast running as the racing season approaches. Once you begin racing, intervals will have been phased out altogether in favour of faster and faster hyper-fast running sessions (with fewer repetitions, of course!) and the race practice sessions.

Gerschler stated that maximum speed can be developed by 100-metre sprints. However, you should maintain your overall volume of running throughout the year, and all year you should be doing weight training to assist your running (see Chapter Five).

When I was training at my best, I was able to run from three to six hours a day, taking in interval training, hyper-fast running and race simulation as part of the training "package". Every day I ran the equivalent of a marathon or more. My body was able to sustain this kind of workload only after many years of continual and consistent hard work. The only problem I had was wearing out a lot of shoes; I did not wear out my body. For interests sake, I am listing an example of several days of training that I did prior to achieving my world record for 5,000 metres (13:36.8) in 1956. (Caution: this is not a schedule to be copied by any athlete or runner without many years of background and with exceptional ability).

Day One

7:30 a.m. - 30 minutes run.

Noon - 4 x alternate 800/1,200m (2:08, 3:11, 2:08, 3:11, 2:09, 3:12, 2:08, 3:13). Total time: three hours.

6 p.m. - 4 x alternate 800/1,200m (2:08, 3:10, 2:09, 3:12, 2:09, 3:12, 2:09, 3:13). Total time: three hours.

Total for the day: six and a half hours running.

Day Two

7 a.m. - 30 minutes run.

Noon - 8 x 800yds (1:58-1:59 followed by a five minute jog). Total running time: two and a half hours.

Evening - 10 x 440yds (57-58 seconds with a four minute jog). Total running time: two and a half hours.

Total for the day: five and a half hours running.

Day Three

7 a.m. - 30 minutes run.

Noon - 12 x 440yds (55-57 secs with a six minute jog). Total running time: two and a half hours.

Evening - 4 x 1 mile (4:11-4:15 with a 10 minute jog). Total running time: two and three-quarter hours.

Total for the day: five and three-quarter hours running.

Nowadays, running on the modern rubber track, and not the cinder track I used to do the above training, means that running times can be greatly lowered by as much as one and a half seconds per lap (taking into account the slightly shorter metric distances). In addition to all this running, I was doing a great deal of weight training!

It is important to remember that when you run your race simulations, you must do so in a less stressful manner than when actually racing. Take it easy and forget about sprinting the last lap; just run along at a comfortable pace. The object is to accustom your body and your mind to running the distance. My favourite runs were 2 miles in 8:40 to 9 minutes, four miles in 18:30-19:30, and three miles in 13:30-13:35. I liked to finish these runs quickly, with a last lap of about 60 or 61 seconds, but not flat-out (I have done 53.8 seconds for the last 440 yards of a 5,000m race). You can do the same kind of running, below your maximum ability, over distances ranging from 3,000 metres up to 10,000 metres, although I am sure that very few runners can do the type and volume of very fast running I was doing in the 1950s. Initially, you will have to settle for running well within your capabilities - with times a little more conservative.

But how can you find your particular level? How do you know how fast to run these fast stretches?

You have to seek out an experienced coach to match your training schedule to your ability at any particular moment. A runner cannot do this himself very easily. If you are a coach, you must make sure that you are very careful to gauge the abilities of your athletes correctly. It is important that you do not demand more than the athlete is able to reasonably deliver, whilst still being able to recover for a similar session the next day. I like to set a target time my athletes can easily reach - then they always succeed!

I deal with about 100 different facets of training when trying to produce champion runners. Most coaches I know understand about 20 of these 100 facets, some coaches know 45 or 50, and I have known one or two who know all 100 facets of the art. The point I am making is that: (1) there is no detail of your life or your training which is too minor to be considered in relation to your training schedule; and (2) it is crucial to find yourself as good a coach as possible, because it is not possible to take guidance solely from a piece of paper (like the training schedules you frequently see published in magazines, and the schedules of my own that I have cited here). You really need a mentor to save you from making the 1,001 mistakes that can be made in training and racing. A good doctor is also important (see Chapter Six on diet and vitamins).

Now that you have become very fit after a good solid period of training, and are also very strong, you will want to race. Before a big race your body must be freshened up from all the hard work in order to achieve your top form. I have actually spoken recently to "top" coaches whose policy it is to send athletes into competition tired. This is wrong! Bill Toomey told me he had five days of zero activity before winning the decathlon in the 1968 Olympic Games in Mexico City. The high altitude there might have had something to do with this exceptionally long rest before that particular competition. A runner will usually relax his training load for at least three or four days leading up to a competition -

but you will need to do something fast the day before and even the morning of the race in order to "clean out the pipes", open up your breathing, remind the body about running hard, and reassure yourself that you can still run. I have run two world records in four days, and raced eight times in a week, still running close to my world-record level in the eighth race; racing was resting for me. So it has to be said that rest is a relative thing! Some of my rest days before a world record race would kill a jogger. One man's meat is another man's poison. Everybody is different. A good coach will know what each individual needs in order to do his best racing. If you are racing twice a week there will be no time to do any hard, fast running at all. Just 40 minutes on the forest or golf course twice a day will suffice.

Psychologically, you must take every race seriously. Do not run races for training and do not train through races. Prepare specifically for every race. Always race your best. Do not race if ill, injured or unfit. Build up a good racing record because this is the only way to avoid developing bad racing habits, like dropping out. Either race properly or don't race at all!

People ask me about specific training for the marathon or the 3,000, 5,000, or 10,000m. Basically, the best 5,000-metre runner will be able to run with the very best marathon runners if he wants to, and has trained over a long period. Examples of this include Carlos Lopes (13:16 5,000m, 2:07 marathon), Alberto Salazar (13:11 5,000m, 2:08 marathon), and Ingrid Kristiansen (14:58 5,000m, 2:21:06 marathon). Distance is no problem for the best athletes. Anyone can run a long way if they go slowly enough; however, as soon as you begin cracking on the speed you'll soon crack up if you aren't able to run fast. A runner like Mary Decker ran 1:56.3 for 800 metres and 31:35.3 for 10,000m, and proved herself to be unbeatable at every distance in between. She could run a world record marathon, too. If you have speed (which you are either born with, or work at for years to acquire), you will have all your competitors over a barrel.

The system of training I have outlined in this chapter will make you very fast and strong, and give you the ability to run races over a wide range of distances much faster than you ever suspected possible. All you have to do is decide which distances you want to run - either because you like a particular distance, or because you have a particular aptitude for running that distance (or because you can make the most money by running that distance...). You should make an effort to concentrate to some degree on a particular distance(s), however, as we all know the saying: "A Jack of all trades, but master of none".

Organising Your Training Programme

Almost every Sunday for the last 40 years I have done an "extra long" run, preferably over very difficult terrain, in the mountains, up and down steep hills, or through forests. The Surrey hills in England were a great place for this type of training. An ideal Sunday session would be a three-hour run in the morning, followed by an easy run of 30 minutes to an hour in the afternoon. We had some really mad Sunday runs in the 1950s. At times we covered as many as 40 miles in a day, just for the hell of it.

How my training is organised during the week is a result of the fact that in the 1950s in London it was only possible to use the track on Tuesdays and Thursdays. The Tooting Bec track where we trained was only floodlit on those days during the winter months. So a tradition dating back 40 years, and based on the limitations imposed by the lighting situation at Tooting Bec, has been dictated to the athletes I train, first in England and later in New Zealand. Our hard training days have always been Tuesday and Thursday, with

relatively easy running on the days in between. Every champion runner we had in our Otahuhu Club in Auckland, including Anne Audain and Alison Roe, was initiated into training with this system - with very long runs in the forest by the sea on Sundays. Hard time trials or races were held on Saturday. Some of the champions at Otahuhu would run both a time trial on Saturday morning and a club race on Saturday afternoon. We had early morning runs (before breakfast) of 20 to 30 minutes. The evening runs were between 45 minutes and two hours. On average, the top runners at Otahuhu were running between 70 and 120 miles per week. We did our interval training or hyper-fast running on Tuesdays and Thursdays, depending on the time of the year and the type of races we were preparing for. Monday, Wednesday and Friday were easy "footing" days. This type of schedule provided overwhelming success for the South London Harriers in England, and for the Otahuhu Club in Auckland. Thirty-five years is a pretty solid length of time over which we launched many champions and record breakers; runners over the full range of racing distances from 100-metre sprints up to the marathon. I believe that the success this type of training provided us with is ample justification for me to propose it as the best way to organise your training.

In my pre-Gerschler days, a typical week of training for me when in top form was as follows:

- Sunday:** am - three hours run, Tooting Bec. Flat.
pm - four hours walk. Faster than joggers today!
- Monday:** am - 30 minutes run, Coulsdon Downs. Hilly.
pm - two hours of strong 100 paces, soft 100 paces, Coulsdon. No easy running!
- Tuesday:** am - 30 minutes run, Coulsdon Downs.
pm - three hours track running, Tooting Bec, including Zatopek-style interval training [40x300 jog 100; or 30x400 jog 100; or 60x200 jog 200].
- Wednesday:** am - 30 minutes run, Coulsdon Downs.
pm - same as Monday.
- Thursday:** am - 30 minutes run, Coulsdon Downs.
pm - same as Tuesday.
- Friday:** am - 30 minutes run.
pm - one to one and a half hours, as Monday.
- Saturday:** am - 60 minutes run.
pm - three hours hard cross-country, Coulsdon. Hilly.

The eventual range of my running, despite an initial limitation of raw speed, went from 35.6 seconds for 300 metres, through to international class half-mile races of around 1:52 (though I think I could have run under 1:50.0), to world class 10,000m races, and a listed World Record over 20 miles of 2 hours. I defeated the 1956 Olympic Silver Medalist over 1,500 metres and world record holders Peter Snell and Wes Santee over a mile. I was able to beat the world records for distances ranging from 3,000 metres through to 20 miles. I am one of only three athletes who has held world records and been ranked among the top 10 in the world in the 1,500, 5,000 and 10,000m at the same time. (The other two are Kenyan Kip Keino and Belgium's Gaston Reiff). I was ranked in the top 10 twelve times in 10 years. This is the longest span of time any athlete has been ranked in the top 10.

So, the training programme I followed gave me everything, including the ability to lead a race for the entire distance, or to wait and sprint past everyone at the finish (except Herb

Elliott, who was unbeatable at every stage of almost any race). I wasn't a "sitter" by any means, but a Jack-of-all-trades racer who took races anyway they were offered up. I also believe in doing special training to change speeds instantly; this I did during the three hours in the woods of Surrey. I sprinted every 100 metres - especially up hills - throughout the three hours until my mind and body were infinitely strong. As a result, a race of hard surges which was hard on the rest of the guys, was easy for me to handle.

Of course, I am writing here about the very top level of my training and racing capacity. It must be emphasized that it took me many years to get to this level. In order to reach such an incredible capacity yourself, you must be willing to train and race non-stop for six to eight years. I went against all advice except that of Gerschler and Zatopek in those days, for example by running multiple races in major meets - like the hard international 1,500-metre race at Bislet Stadium in Oslo followed by a win in the 5,000 metres a few minutes later against most of the best runners in the world. At the age of 14, I won an Army Cadets' Junior Mile race, then ran a few minutes later to place second in the Senior Race in an identical time. Though now I am against multiple races for young runners, and believe it is important that young runners do not train intensively before 17 or 18 years of age - I did it! Everyone in England, even though they were only aware of half the story, criticised the incredible training and racing I was doing.

I survived against all the ideas of the so-called experts. I had made up my mind to be one of the best racers in the world, and it took me eight years of ultra-volume running to get to the top; I was not a gifted runner. It wasn't uncommon for me to run more than 12,000 miles a year during the 1950s, in training which took more than six hours on some days, and required an incredible effort most mortals would cringe at. The point of all this is that there need be no limits to your achievements, so long as you are willing to keep at it. Limitations are always self-imposed. However, I know now that a runner can get the best results on rather less than the ultra-marathon preparations I made.

On days when you don't feel like running hard, always try to do some running - Gerschler's rules required a minimum of an hour a day of easy "footing" (assuming one bears in mind the safety controls described elsewhere in this book). One day in 1956, at the track in Croydon, England, I felt lethargic but still jogged around for half an hour. I felt better so then did a few 100-metre strides in my spikes and started to get going. Then I decided to run softly a 3/4 mile trial. I chose 69 secs speed, which I considered jogging speed, because I usually ran 3 minutes. Then I ran a 440-yard jog. I felt better and better and finished up by running 8x3/4 miles in averages of 3m 27secs. That was a nice easy day of running with no stress - a total of 2 hrs 35 minutes and a weight training session of 30 minutes. An easy day! A hard day would include the same type of training but much more intense speeds. I want to stress once again that I cannot do such things today, and only runners in super-human condition can get away with this kind of training, and then only after many years of hard effort. The average runner will end up in hospital if he or she attempts this kind of training. Moderate your efforts according to your fitness and ability, and do what you enjoy. I always enjoy my running.

There is another side to the same coin, however. If you never try harder, you will never get better. Jogging, and more jogging, will turn a runner into a walker in short order. Unfortunately, we read of some really good runners who spend a lot of time jogging around with no speed work; but the speed running they get in the many races they run overpowers the jogging and does them good. This type of runner very often starts the season by turning in mediocre times and usually does not come around to running very well until after the major championship events have passed. Their performances improve because of the fast "training" they have achieved in their racing. They do not realise that

their actual training is all but useless and it is only their racing programmes which make them perform well. The problem with this approach to training is that there is a limit to how much your body will adapt to the stresses of racing, if it only encounters those stresses every couple of weeks, or, perhaps, only once a month. The result for many very fine runners (who adopt an LSD approach to training) is a gradual deterioration of racing performance over several years.

Another popular aspect of training which I think is very dangerous is that known as "periodization" - that is, breaking down the training year into various "phases", each of which is divorced from the others. Thus, the beginning of the year may be devoted to a slow distance "build-up", the second portion of the year devoted to hill training, a third part devoted to interval work and then speed training, and finally (though most of these runners never get this far) a racing season undertaken. The difficulty with training in this manner is that you go along quite well with one aspect of training (e.g. long distance running), and then suddenly, on a certain day, "Bang!". You start hill-bounding, or speed-training, or something new, and the body simply is not ready for the change, and invariably, year in and year out, you are more often than not injured. The body should be trained in all aspects of running, all of the time. Only the emphasis should change as you progress through the year; no aspect of training should be entirely given up for any significant length of time. The balance between different types of training (distance running, intervals, hill running and speed training) should be adjusted as the year progresses.

Keep trying to get stronger using weights and gymnastics exercises for all-around fitness. Keep running some hills in every run (i.e. don't run around flat places all the time). Keep some speed training in your programme all year. Basically, keep doing a lot of running. Merely change the stress and balance between the different aspects of your training as you move through the training year. For example, in the weeks immediately prior to the start of a racing season, a lot of speed running (including interval training and hyper-fast running) should be employed, as discussed earlier. During a racing season, like the US High School season (when it is not uncommon for teams to have two meets each week), no interval training or hyper-fast running is necessary. If the high school team must run two meetings in a week, the races provide all the hyper-fast running needed. The other days are necessary for recuperation and freshening up, in preparation for the next race. It is not uncommon, however, for young runners in US high schools to run two or three races in every meeting and then to train hard with intervals or hyper-fast running on the days in between. All these youngsters need is to run easier on the days between meetings. They need rest from the killing races, not persecution!

Ideally, it is best to race every two or three weeks, or to have a group of races scheduled during a week or 10-day period, after which the athlete needs a brief spell to recover, before going back into a period of constructive training. High school track and cross country programmes in the US are decimating many of the best young runners, because they schedule too many races in too short a time. This is a tragedy. In addition to these murderous racing programmes, many coaches employ a "gun-at-the-head, do-it-or-else" psychological approach which destroys many more athletes than it helps. Do I have to attack the adults and media men who constantly praise this sort of stupidity in order to make my point? Many, many young middle and long distance runners run two or even three races in the High School Championships. These youngsters often disappear once their high school careers end.

The best advice I can give to these young runners and their overzealous coaches is to run no more than one, perhaps two races if there is a generous time gap between them. The

exception to this rule is sprinters in the 100- and 200-metres. Coaches who consistently require their young runners to run these extraordinary double and triple efforts are killing off much of the incredible talent that exists in the US. Athletes who endure this insanity must accept the fact that they are going to be also-rans once they leave school, because much of their ability will have been eroded. It will take an athlete a season or two to overcome the effects of his being abused as a schoolboy, but many never recover. If he can survive the years immediately following leaving high school, then he has a chance. The schoolboy phenoms of yesterday get a rude shock when they try to perform at the top of modern track and field.

So what we are talking about is planning a racing and training schedule which makes consistent development (over several years of hard training) possible. A good training programme is one which allows the runner to consistently work hard every day. A programme which overkills a runner one day, so that he has to back off and recover for several days before the next hard day, is too hard. A coach and athlete who plan ahead together, and who have a pretty good idea of how and where and when they will race even before the season starts, will have a reasonable chance of pulling everything together for a successful season. Flexibility is also necessary in case of unforeseeable circumstances, or if the athlete's ability suddenly blossoms into another racing area (for example, an 800-metre runner who suddenly discovers an aptitude for the 400m). When this happens, it is important to concentrate on the athlete's best event. An athlete will pick up a new "favourite" event because he has found he can be more successful in that one. There is nothing like success to breed satisfaction. Many superstars in track and field started off as champions at school in some other, sometimes completely unrelated event. These switches in speciality may be the result of having a very smart coach who saw potential in a new area and channelled the athlete in that direction, or, more often than not, may occur by accident.

When I begin to train an athlete, it takes me six months or more to evaluate the individual's talent and character. During this period, I test the athlete and adjust the emphasis of training in order to find out what his or her strengths and weaknesses are. The coach must learn to capitalise on the athlete's strong points, while subtly removing his weaknesses. An athlete must have no weaknesses at all, but rather be strong in all areas which pertain to his event - both in the mind and in the body. A coach's job is to deal with the best athletes, and athletes with less ability, in the same way. Praise is to be given to all athletes, regardless of their ability. Each is making the same efforts to improve. Even though we are all born equal, some are more equal than others. Encourage everyone who has the gall to get out and have a go. A lot of champions started out as chump runners.

What about a year-round programme? Is it really necessary to rest for two months every year the way some superstars do? Do they really lie around in bed without twitching a muscle for two months?

Of course not. I have not seen one great runner do this. It may be a good idea to switch to different activities for a few months, to get away from the daily regime of your speciality - play a game; go cycling; go swimming; lift weights - but never stop everything completely. I have known very many champion runners who kept at it summer, winter, spring and fall for years and years, beating everyone in the process; and when they take a prolonged break they never get back up to the same level again. At the other end of the spectrum, there are some champion runners who like to devote a part of the year to terrific effort, and then fall back on some other activity for a time - calling that period a "rest". But they still remain very active. Different systems fit different individuals, and

the coach and the athlete must work hand-in-hand in order to discover what works best from one year to the next. What is necessary this year may not be exactly what is required in the next. In general, however, a change in programme is as good as a rest.

I have already said that I am against a long period of "build-up". By admitting that a build-up is necessary, an athlete is acknowledging that he has gone downhill. And it often takes an athlete a period of time to recover from a build-up. A build-up usually starts at the end of a hard season when the best thing to do is to go fishing (but not for two months at a time!). Take a short break, then come back fresh, and aim higher for the next season instead of sliding back down to where you were a year or more ago. Do not start shuffling about, but work for next year. I want my athletes to stay at the top, not to abdicate their excellent fitness and slide down to the pack.

How long, then, does it take to get fit in the first place, if you have never done anything at all, not a single step?

Then you are a special kind of human being, who needs to do a little exercise a couple of times a day (5 to 10 minutes of gentle walking and slow running) until you get your body to acknowledge that there exists something called exercise. This should be preceded by a visit to the doctor.

This initial period of exercise is going to test you out. It is going to be difficult. You will get stiff muscles and get comfortably tired. You will sleep more, and better. So take this preliminary exercise very easily. Don't do much, but keep at it regularly, and, most importantly, do not give up, and don't miss a day. When you have managed this for at least a month you will be on your way. The most difficult thing to establish is the new pattern of living; to allow the body to achieve a basic level of fitness.

You only increase the volume of exercise when it becomes easy to do so. You must pay attention to the technically correct way to run right from the beginning, and ensure that you have the correct equipment to do this, as we have described in this book. You can then start some of the other aspects of training, making things progressively more difficult and strenuous for the body. Find a hillier place to run. Try to run your favourite course in a faster time. You could even try some of the easiest interval sessions a couple of times a week. At the weekend try a longer run of up to half an hour. Remember that these are still early days.

You will have read how champions result from years of hard running, so you yourself have to follow a steady path of improvement, too. Don't rush at running 10 kilometres, let alone a marathon, until you have done two or three years of sensible preparation. A friend of mine in England ran in the London Marathon without adequate preparation, and today is in bad shape, suffering from diabetes.

Lastly, look around for a coach. Join a club. Try Orienteering. These are fine ways to get fit and enjoy running.

Sprinting

To run really fast in a sprint is most often a gift some runners are born with, but others can acquire it through years of hard work. We have all seen the gifted type who ran away from us at school without training and with consummate ease on a 100- or 220-yard sprint. Give these guys and girls a pair of spikes and they go like a rocket for the short sprints, but die a horrible death if they try the same thing for a quarter-mile.

These gifted people are destroyed by over-training and stretching exercises. Their magical ability is eroded away slowly and surely over two or three seasons by the games of hours of exercising, and drills of false technique that are popular today.

Two examples that spring to mind are Houston McTear, a 9.9 second 100-metre man at High School who was worn down to a 10.6 second man, and finally a nothing-at-all man. Or Henley-Smith's New Zealand Schoolboy Champions who ended up injured most of the time, and consequently unable to climb into the top tiers of senior running.

The sprinter is best personified by a fellow who trains only two or three times a week. He spends a lot of time playing other games, like football, basketball or soccer. When he does train, he does very little volume, but a lot of sprinting at high speed, especially out of blocks - this in lightweight racing spikes. He cannot last beyond 200 metres as a rule, but can hurdle like a champion with a little proper training, and can be champion in the long jump.

Jesse Owens told me many of his secrets at the Tokyo Olympics back in 1964. He always stayed fresh; he never trained too hard; he never jumped into the long jump pit except in a competition. His philosophy was: "If I can hit the board at 10.2 speed then I am going to out-jump all those Turkeys".

The sprinter goes to the track, jogs a lap, does a couple of exercises, puts on his spikes, sprints lightly a few times over 20 to 30 metres. Then he gets down to business with up to half a dozen fullout sprints, and he goes home. He is only at the track for less than an hour altogether. Some days he does one or two dozen starts out of blocks as his training session. This he does about three times a week.

Olympic Champion Alan Wells told me that he didn't jog at all because he didn't believe in training himself to go slowly. He started off with light springing runs on the grass over 20 to 50 metres, with a walk back between them.

Prior to a race, the sprinter begins his warm-up in the mind. He works himself up mentally, and gets full of adrenaline and excitement. If you want to eliminate that super-animal condition innate to all good sprinters, make them warm-up for three quarters of an hour, and fool around doing damaging exercises for another half-hour. He or she will then be guaranteed not to have enough adrenaline or energy left for the race.

It is essential for the sprinter to do all his running in racing shoes. Immediately before the race starts he should not be running fullouts out of the blocks, or sprinting like hell at all. Instead, he must save these maximum efforts for the race alone.

So, sprinters are a breed apart. Keep them fresh, get them twice as strong with weight training. Hold them back so that they can explode in the races. When a sprinter runs a fullout effort, stop him taking a short interval - that would destroy his raw speed and start him on the way to becoming a distance runner, by developing his endurance to the detriment of his speed. A suitable rest associated with a fullout sprint is at least 10 minutes. Following this, a mini-warm-up is required (e.g. run lightly over 100 metres, incorporating 3 or 4 short accelerations). Then he is ready for the next fullout effort.

An exception to this rule is when the sprinter does short starts over 10 to 20 metres. After these, the sprinter should walk back slowly to 20 metres behind the blocks, until the coach calls him to the mark again. In this case, the rest interval would be fairly short, because the coach and runner need to get back to work quickly in order to reinforce the learning process that is going on.

At all times, the sprinter should move lightly on his toes like other runners, with a tempo of at least 3 steps per second. To compete with the world's best, he is going to have to move even faster than this, at up to 5 steps per second. This is where so many sprinters fail to match the champions, as they find it impossible to move their body parts that fast. This is because they never train to move so fast, and for most of their training practice actually do the opposite; performing slow motion drills and activities that destroy what speed they have.

Everything that a sprinter does on the day of the race is of critical importance to his performance, just like any other athlete. In Tokyo, I watched Bob Hayes practising starts on the morning of the 100 metres Final. He ran them in his slacks and racing spikes in a fast and energetic manner. He wasn't sitting around getting lethargic. Before racing, the sprinter has to prepare himself psychologically. He must get worked up. He must think of the race as being a life and death matter. There is a fine line which is not to be crossed here, however. The sprinter has to lift himself to a very high state of physical and emotional preparedness, but he must not do hours and hours of physical activity and thus tire himself out. At the same time, he has to be able to relax, go to sleep, and get his mind away from the race; a kind of contradiction. An example of this is how I myself tried to relax before a big race. I liked to get to the Stadium early, and find a nice quiet place to lie down and read a book. Generally I could fall asleep for a while; but don't forget to have an alarm system for this. Mike Larrabee, Tokyo Olympic Champion, fell asleep in the Warsaw Stadium, and only woke up in time to rush out onto the track to go to the mark! He lost the race.

Once again, I will use Alan Wells as an example of the difference in warm-up between winners and losers. Wells warmed up in New Zealand for a sprint race by springing around lightly for about 10 minutes, while the local losers spent an hour doing exercises and excessive sprinting. Wells beat them by a huge margin, mainly because they were so tired when they got onto their blocks, whereas he was as fresh as new paint.

A sprinter must run with the most powerful arm action of all the different runners. He has to use maximum power all of the time in the same mechanical way as all runners.

The popular fallacy that a sprinter, or indeed any runner, should deliberately take bigger steps is a nonsense. If we went in for 3.5-metre steps in a 100-metre race, it would necessitate less than 3 steps per second. To do this, you would have to jump too high in the air. Consequently, you would be slower over the 100 metres because you would be spending too much time going up and down instead of forwards. In fact, on the contrary, a series of shorter, quicker steps is used by the top speedsters. Carl Lewis employs about 50 steps in 10 seconds, while Marlies Gohr of East Germany utilises about 55 steps in her 11-second 100m. This is equivalent to around 5 steps per second.

To be a champion sprinter, you must not fail at the start. By this I mean that you must not get left behind. You must sharpen your wits; you must be able to react very quickly to the starter's gun. However, you should not dissipate all of your energy in an all-out explosion in the first 20 to 30 metres. Accelerating smoothly, staying under control, and going fullout in the final half of the race is the way to run the 100 metres. It is during the last few metres of the race that most sprints are won, and very rarely in the early stages. The most significant exception to this rule was Armin Hary, Olympic Champion of 1960, who won many races from the blocks with his electric starts, which all of the other competitors complained were false starts. The general rule was illustrated by Carl Lewis when he won the 100 metres Olympic Final in Los Angeles. He was left behind at the start, and only grabbed the lead in the last 30 metres or so of the race.

Another important factor is the correct stance on the blocks. The hand support in the set position should be centred on the lead foot as seen from in front of the runner. The body weight should rest on the front foot, ready for the transfer of the weight forward when the first step is taken. If the hands are not centred on the front foot, the sprinter will zig-zag out of the blocks in his initial steps, wasting energy, and so run slower than he could. The lead foot should be two to two and a half hand spans behind the starting line (though individual differences should be observed; the most important aspect of the stance at the start is that the sprinter is comfortable and able to move fast from the position that

results). The rear foot should be placed so that the knee of the trailing leg is resting on the track next to or slightly ahead of the lead foot's toes in the "On Your Marks" position.

When the set position is called for by the starter, the sprinter should raise his seat up and at the same time rock forward into the balance position. Nearly all of the weight is taken on the hands and the lead foot. The rear foot merely rests lightly on the rear block. Its job will be to move as fast as possible in the first step forward on the "gun" - NOT, AS MANY PEOPLE SAY, TO PUSH OFF THE BACK BLOCK FIRST! If you do that, you will be left behind as the others will be away on their first step! Isometric pressure should be applied to the front block in the set position, and an inhalation made while coming into the set position. When the gun is fired, the runner should exhale explosively as the back foot makes the first short, sharp step. A synchronised short, sharp arm punch should also be made with that first step (Note: Not a long, slowing arm swing which will delay the athlete). The first quick step with the back foot should accompany the powering off of the front foot. Don't waste time; the next step must come fast after the first one. This should be achieved by strong, short power movements with the arms and legs. You will need a series of short steps to facilitate rapid acceleration (5-10 depending on the individual's strength), before you will be able to get up into the full running stride.

How high should the body be raised in the set position?

The mechanical position of the legs decides this. If the seat is raised too high so that the legs are straight, it will be difficult for the runner to generate much power. Conversely, if the seat is too low, not only will the centre of gravity be too low, leading to a waste of energy after the start because the runner will be forced to lift himself up into the higher normal running level, but also the runner won't be able to propel himself forwards particularly well when sitting on his haunches!

A good test of the starting position is to gently push the runner forwards when he or she is in the set position. If the runner overbalances, the position is fine, but if he does not, he will need to ride forward more in the set position. Too many sprinters lose a lot of ground at the start of a race because they rock forward into the overbalance position **after** the gun has been fired. While they are doing this, the other runners will already have taken their first step.

If a coach asks a runner to do leg speed practice he is leading them up the garden path, because every single step you run must be at racing tempo. If you do not obey this law, you will erode away your running ability. I once heard Rodney Dixon, after losing another race, make the excuse: "I haven't done any leg speed"; the assumption being that when he starts rattling his legs along it will enable him to beat them all tomorrow. Just like that.

It may seem that I have spent a large part of this book giving overly elaborate and detailed explanations and descriptions, but this is essential because of the complexity of the art of running. It has all been done in an effort to make life easier for aspiring champions to succeed. I could quite easily have written much more. So many athletes are out there making silly mistakes that I could have saved them from! Like Greta Waitz, John Treacy and Mamede performing poorly, for them, at the World Cross Country Championships through making simple errors in their training close to the race, all the way down to the schoolboys and joggers doing silly things in their running that either injure them, destroy their best running, or kill them for good as far as running is concerned. The saddest cases of all, however, are those runners who have actually died through making cardinal errors in running, because they assumed they knew all the answers, or thought that because they themselves had written or read some of the books that have been printed, they were right.

CHAPTER FIVE - WEIGHT TRAINING

Objective And System

A race is an all-out effort over a short period of minutes or seconds. The aim of weight training for runners is to simulate as closely as possible the movements used in running their special event, and hence the demands which racing makes on the body. In this way, the body's strength can be developed, with an emphasis on ensuring that the body is balanced in strength, and not lopsided with one side stronger than the other, as commonly occurs because most people are either right- or left-handed. A runner should be equally strong in both sides of the body - left and right - and have balanced strength between the front and back of the body.

Many athletes I treat for injuries are stronger on one side of the body than the other, and it is my belief that injuries are often caused by this imbalance. The weaker side is pushed or pulled by the stronger side until it gives out. The most common injury of this kind is of the hamstrings, resulting from unbalanced back strength. Weights used in training should therefore demand equal efforts from both sides of the body, and to achieve this I have found dumb-bells very useful. Many of the runners who decry the positive effects of weight training have gained their superior strength with the assistance of a good Doctor or Chemist. Others - like Sebastian Coe and Steve Scott - are open about the significant role that weight training has played in their training.

With dumb-bell exercises, you should try to use heavier and heavier weights up to as much as one-third or even one-half of your body weight. This is very difficult. If you are able to easily handle as many as three sets of ten repetitions of a particular weight, then the weight is too light. If you cannot do at least six repetitions, the weight is too heavy. The same rule applies to weights requiring a bar-bell. You should aim to work to at least two-thirds or more of your body weight with bar-bells. The ultimate test is to be able to lift the equivalent of your own body weight over your head. When you can do this, you will be strong enough for running events.

Top field event performers and sprinters can lift weights up to the level of the very best weightlifters. Valery Borzov, 1972 Olympic 100- and 200-metre Champion, was fantastically strong. World record holder Jarmila Kratochvilova became so powerful that her femininity was drawn into question (actually, her fantastic ability was the result of almost 20 years of hard training).

I was first introduced to weight training in 1952 by John Disley, who handed me a bar with 15 pounds of weight on it. I was puny (though already British running champion and record holder at this time). The 15 pounds of weight was almost impossible for me to push over my head. My arms and upper body protested violently against the exercise, and after one session with this "massive" weight my muscles were dead. By the next day, however, I began to feel the positive effects of my efforts, with strength seemingly beginning to flow through my body. In no time at all, I felt my three-hour runs going better. I couldn't afford to buy my own weights or go to a gym, so I found a log of wood and started my weight training at home in the garden, with builder's lead nailed to the ends of the log. I got stronger and stronger and, suddenly, I was stunning people with my sprint finishes, as well as pounding many of my competitors out of sight before the sprint even came round.

In 1953, a generous gentleman from Surrey (whose name I have, regrettably, forgotten) gave me a set of weights after seeing a picture of my training "log" in the newspapers. I

did weights in our back garden facing the kitchen window. My mother often pulled faces through the window as I did the repetitions, grunting and gasping, and I had to beg her not to break my concentration while I was going at it like hell, because it made me laugh! Al Murray, the famous weight lifter, gave me solid advice on what and how to do weights. I went at the weights very hard in 1954, and so started the season in fabulous form. I set a world record for a grass-track mile (4:05.2), then suffered a broken bone in my foot from an accident and missed the rest of the season...

From those early days on, weight training has been a part of my preparation for races, and that of the athletes I train, although I have on occasion been "kind" to many of my trainees in New Zealand, allowing them to get away with only hard running. I will not make that mistake again. From now on, it's weights and running or nothing.

The most astounding thing about weight-trained athletes is that they often don't look the part. It is possible to get very strong without looking like Mr Universe or Rambo. Some very thin-looking individuals can be extremely strong, despite their skinny muscles and frames. Weight training does not go hand-in-hand with muscle bulge, unless you either munch a lot of steroids, or do a lot of slow, easy pumping. When we do maniac, high speed, all-out maximum weights, we get very fast and strong without putting on any bulk at all (you will not begin to bulge all over the place, girls). Most truly super-fit people don't look the part; fitness is a hidden quality. But when they "operate", however, their performances reveal those "hidden" talents. The opposite of this case is The Incredible Hulk, who can't even jog across a room to visit his girlfriend without needing a rest when he arrives.

Before getting onto the specifics of an effective weight-training protocol, here are some general guidelines about fitting weights into your overall programme:

How often should one do weight-training?

Every second or third day is about right, along with a full running programme (curtail your weights several days before a race). Your weight training should also continue through the height of the racing season. Do not give away all the good training you have done just when you need the greatest amount of strength.

How hard should the weight-training be?

There are two types of weight sessions: (1) a full-out session in which you do all and every exercise as hard as you can; and (2) an easier session with half-dosages of fewer exercises. It is not uncommon for a tired runner to feel much fitter after a moderate session with the weights. These sessions seem to flush out your muscles. On the other hand, the full-out, go-for-it, maximum sessions tend to put the body down a bit, and numb it for a while; so those sessions should never be attempted near to a race day (say within six days). The body does cope easily with easy routines, however, and I sometimes even find that a few exercises with strong weights before a three-hour running session can bring fantastic strength into the running, making it feel much easier.

I have always found my best running fitness - when I was able to set world records and finish races in stunning fashion - to be absolutely tied in with my best form with the weights. The stronger I was at grappling with the weights (combined with a lot of hard running), the better I was on race day. It is interesting to note that the New Zealand veteran Derek Turnball, who runs world records in his age group, does weight training nearly every day in the course of his job. He will deny this because he never touches a bar-bell, but he is doing hard physical work all day long on his farm, and is as strong as a horse. He also does his running at an elevated altitude in the mountains around his farm. Derek has three major strength factors at work in his daily life: he goes for long runs; he runs up and down mountain paths; and he does weight-training as a way of life.

If you are an average sedentary person, you are likely to be as weak as a chicken, the very opposite of Derek Turnball. If this is the case, go to a specialist in weight lifting and have him test you for back, leg and arm strength. You will be shocked by your weakness. Then do weights for a month and go back to be re-tested; this time you will be astounded by your improved strength. Your running will become easier, and you will begin to go faster and faster.

I have a chuckle every time I go into a health club. There are runners and tri-athletes playing silly games with puny weights, instead of getting "stuck in" and doing something that would be really beneficial for them. We go into the gym and smash away for 45 minutes to an hour, breathing like rhinoceroses, and then get out. The average inhabitants of the modern weight room fiddle about looking at themselves in the mirror, and never seem to get going. They are there for hours, sitting on their hands admiring their expensive gear and big muscles in the looking glass.

One example of this was Richard Okesene, who was New Zealand Javelin Champion. Richard had a fantastic body, at least that's what the girls told me, and would play around with huge weights - in fact, some enormous weights, in the 300- to 500-pound range. But his capabilities as an athlete were puny, compared with his apparently tremendous strength. His heart and circulation were so bad that he couldn't last out a dozen reps in a light-weight exercise session. His endurance was nil. By the time he had run up the 30 metres to throw the javelin, he was exhausted. After only three months of our style of weight training, plus some hard running, his best throw in the javelin went from 60 metres to 76 metres. If Richard continued in this style of training, I am sure he would be able to throw 100 metres. Athletes like Richard are to be found everywhere, but like the dinosaurs with their big bodies and little hearts, they are bound for extinction.

Before I began weight training, I was a long distance and cross country runner who could grind it out with anyone, but a constant loser in a sprint. A diet of hard weights, however, turned me into a complete competitor, one who could pour on the pace and still sprint madly at the finish.

Weight Exercises

- 1 - High pull with bar-bell (for warm-up): one-third body weight, repeated 10 times.
- 2 - Rowing exercise with bar-bell: 2/3 body weight, three sets of 6 to 10 repetitions.
- 3 - Dumb-bell press: one-third to one-half body weight, three sets of 6 to 10 repetitions with each arm.
- 4 - Dumb-bell curls (forward and reverse): one-third to one-half body weight, three sets of 6 to 10 repetitions with each arm.
- 5 - Dead-lift with bar-bell: body weight and more, three sets of 6 to 10 repetitions.
- 6 - One-handed swings: one-third to one-half body weight, three sets of 6 to 10 repetitions with each arm.
- 7 - Clean-to-chest: three sets of 6 to 10 repetitions.

Body Resistance Exercises

- 1 - Press-ups: 6 to 60 repetitions.
- 2 - Leg lifts: 6 to 60 repetitions.
- 3 - Chin-ups: 6 to 20 repetitions.
- 4 - Sit-ups: 6 to 100 repetitions.

General Rules

- 1 - When lifting bar-bells, look forward at a fixed point, with no jerky movements, back straight, knees bent, and bottom down. Grasp the bar and lean back, take the weight and lift.
- 2 - Do weight training every two or three days, and continue throughout the height of the racing season (but not within a week of a race).
- 3 - Warm-up with lighter lifts.
- 4 - Free weights are better for runners than universal gym, nautilus, etc.
- 5 - The deadening effect of weights on muscles is normal, but, because of this effect, do not do a full, hard session of weight training before or immediately after a hard track session.

CHAPTER SIX - DIET AND VITAMINS

Compared to the average, sedentary, civilised person, the highly active, stressed and hard-working runner needs an increased supply of all the essential vitamins, minerals and nutrients. Most athletes pay little or no attention to the food they eat; and some are successful for a time. But it is very difficult to find an athlete who survives at a high level for a significant length of time without paying careful attention to what goes into his body. In "advanced" nations like Britain and the United States, people are fed by giant food corporations which not only monopolize the market, but denutritify the basic foods, reducing their natural ingredients and nutritional qualities to a point where the food is almost useless; and replacing these essential nutrients with a lot of poisonous chemicals and other additives. Many of these food additives are combined in such a manner that they actually destroy vitamins and minerals which are already in the body. If you are an average person, and you eat an average diet, you can bet that you will be suffering from malnutrition, but have been brainwashed by advertising into thinking otherwise.

If you eat nature's foods - fruits, vegetables, whole grains - the only way to get the full value from them is to bend down and eat them off the ground, or reach up and eat them off the tree or plant they are growing on. Every hour and day that passes after a natural food leaves its home decreases its nutritional value. The fresher you can get your food, the better. If you wait long enough (months or years in the case of some foods in cold storage), most of the valuable nutrients will be destroyed. If you eat these stored foods you could get almost nothing in the way of nutritional value from them.

Never eat white flour or its products, nor any sugars, nor any milk that has been homogenised. Scientists can tell you this, unless they are funded by one of the major food companies. Do not believe scientific "facts" that have been purchased on the backs of food packages.

In my nearly 50 years of mixing with outstanding sports performers, I have discovered that it is possible to achieve distinction without proper nutrition, but a malnourished athlete will not stay at the top for very long before degenerating. The most common factor among successful sportsmen and women is that they are health-food and vitamin-supplement conscious. Many are also vegetarians. When you meet these careful and clever eaters later in life (if they have been able to avoid accidents and other acts of fate), they are usually still active, fit and healthy, especially when compared with someone who has lived on the average processed diet.

The volume of food eaten is another factor. Similarly, how food is eaten is important, and, indeed, is just as important as what has been eaten. A meal should be taken in a relaxed, happy and non-stressful atmosphere. Time should be taken to eat your food slowly and thoroughly. The person who gobbles down his food without being relaxed (perhaps he argues, works or watches television during meals) is headed in the wrong direction.

So, if you live in our beautiful "advanced" nations, you need to supplement your nutrition with vitamins and minerals, and to discard those things that represent mal(bad)nutrition. If you are a racing runner, you need even more supplemental help than the average person - and the average person needs plenty. More and more is being discovered about the effects that vitamins have on the body. Hard-training athletes require a lot of extra vitamins and minerals, and must find a clever doctor who can save their lives, and increase their level of performance. It is very easy to go wrong with vitamins. Too much of a vitamin, in some cases, can be as bad as too little. The doctor's job is to evaluate you

as an individual, and guide you in your special needs. These needs will change as your body improves, so it is vital to stay in contact with a doctor who understands the demands of your sport.

I repeat that the requirements of an athlete involved in intensive, energetic training and competition are greatly in excess of those of a sedentary person. Different individuals - especially women - have different requirements. Here is where competent medical advice and supervision comes in. It is nearly impossible for the untrained layman to monitor his or her own body chemistry. In order to avoid nutrition- and vitamin-related mistakes with potentially serious consequences, therefore, consult a competent physician at the outset! This is very important.

Athletes have to deal with three distinct areas that directly or indirectly determine fitness and competence in their sporting activities: (1) the actual training they do; (2) nutrition - how, when, and what they eat and drink; and (3) the amount of rest (including sleep) they allow their bodies to have. If you do not carefully and constantly consider all of these areas, then you will not succeed or continue to succeed as an athlete.

Two people may be given the same food and drink, and yet only one benefit from it. This is partly because how you eat your food affects whether or not your body will assimilate it properly. The digestive process begins with the chewing of the food, and if you swallow food without chewing it thoroughly, its chances of being fully digested are greatly lessened. Saliva is the key to complete and thorough digestion of your food. If food does not stay in the mouth long enough, the digestive process cannot be completed properly and you won't be able to fully utilise your food's nutritional value.

Do not drink when you have a meal. Beverages with a meal interfere with digestion and reduce the nutritional effectiveness of your food. The rule for drinking which we try to observe is: do not drink anything for 10 minutes before you eat, and wait one hour afterwards before drinking again. This regime makes for super workings of the digestive system, and ensures that you get the maximum benefit from your food. This is a most difficult demand to make on athletes, as it is against the "civilised" norm for dining - everybody enjoys a bit of wine or beer with a meal -but you should try to avoid liquids with your meals, especially tea and coffee.

Being overweight is the biggest obstacle many would-be athletes have to overcome. It slows you down. It shortens your life. We derive enjoyment from eating, but you have a choice; either live high and fast for a few years, or take care of your body with a more moderate life-style and enjoy it for a long time.

Just as the timing and the manner in which you eat your food has a direct effect on how much good (or harm) it does you, so it is with vitamins. Certain vitamins work very well together, while others, if taken at the same time, tend to cancel each other out. For example, vitamin E and iron supplements clash. You must therefore take your vitamin E and iron at different times of the day in order to get the maximum benefit from both.

The amount and frequency of taking vitamin supplements follows much the same rules as training. It is better to take your vitamins frequently (with meals) than to take your entire daily dosage in one go. The body is constantly working on the vitamins you put into it, processing them along with other essential nutrients from your food, and absorbing and eliminating them. A frequent constant supply is thus necessary if the body is to take full advantage of the vitamins. This is especially true for the water-soluble vitamins - they are rapidly turned over and flushed from the body.

The amount of each vitamin that is necessary (or safe) remains a matter of considerable debate, but it does appear from the information available, and from my own experience, that large dosages seem to be the best way to help a body which is depleted by poor

nutrition recover its health. The American Food and Drug Administration's (FDA's) recommended daily allowances (RDAs) for each essential nutrient is probably inadequate for a training athlete. In many cases, therefore, it would be wise to multiply up the FDA's RDA. It is essential to get expert advice from a doctor or other professional who understands the demands of your sport and event. You will need to be very careful in the selection of a doctor, however, as most physicians in Britain and the US have little or no expertise in nutrition and biochemistry, and even less knowledge of the needs of a highly stressed, hard-working athlete. Look around until you find a doctor with sufficient expertise before you commit your body and your running career to him.

I frequently use two days of my own physical activities to illustrate the manner and effectiveness with which I have supplemented my meals with vitamins in order to improve my physical performance:

First Day

Cycled 230 kilometres from 8 a.m. to 6 p.m., covering the first 30 kilometres in one hour, after which I ate a mini-meal with vitamin and mineral supplements. This was repeated eight times throughout the day so I arrived at my destination fresh and ready to run six miles.

Second Day

Cycled 30 kilometres, took a mini-meal and supplements; ran for two and a quarter hours, had a mini-meal with supplements; ran for three and a half hours, had a mini-meal with supplements; and cycled 30 kilometres home.

Following these two days of extraordinary exercise, I continued running for two to three hours each day without any discomfort or fatigue. Despite the massive amount of exercise I put in during those two days, I experienced no need to "recover". In order to do that kind of activity, you must either be crazy or very careful with your nutrition; if you are not careful you will come apart. The mini-meals I ate consisted of one 100mg iron tablet, one gram of vitamin C, four small sweets, half a pint of milk, a slice of black bread, and two ounces of cheese. These meals and supplements were taken every hour on the first day, and between activities on the second day. I drank water as my thirst dictated during the exercise. There are other instances where I was able to continue high levels of vigorous exercise because I was adequately nourished. I did not have any adverse effects from this very strenuous activity. This still applies today, and I find it easy to do many hours of sustained exercise, provided I have good nutrition.

Mistakes Made By Athletes

Diet is not the only area in which athletes can make mistakes. A hard-training athlete must take care to manage every aspect of his life. He must closely monitor his body on a day-to-day basis in order to avoid serious problems.

The worst mistake an athlete can make is one that causes his own death. This is obvious, but not as uncommon as one might think. If an athlete is ill, as a result of malnutrition or any other cause, he must take the necessary steps to remedy it. Apart from the obvious, like not running when ill, there are other rules an athlete must obey. You should take your pulse every morning before you get out of bed. In a short time you will arrive at a base

level for your resting pulse. If your pulse has increased by as little as 10 percent above the base level, do not train on that day, and until your pulse has returned to the base level for two consecutive days. A high pulse is a signal from your body that something is wrong (classically associated with a raised temperature and other symptoms, as in flu). Listen to your body.

An example of a man who did not heed this advice was Mike Wells-Cole, British Orienteering Champion. He ran for two hours on a Sunday morning despite an extremely high pulse - he was suffering from influenza. He was dead by 5 p.m. on the same day. I had offered him advice, but sadly he disregarded it, and tragically paid for it with his life. The Royal Navy has a similar backward approach to fitness. I recently went aboard a Royal Navy Carrier in Auckland to offer a day of social running to any athletes on board. I was told by the ship's sports officer that there were no runners on board. Sometime previously they had tried a fitness test to see how far each seaman could run in a specified time. Several seamen dropped dead, so the running was stopped. The correct conclusion to be drawn from this catastrophe was that the crew were in a woeful physical condition, and obviously were not fit enough to fight a war. Moreover, the activity chosen to test their fitness was inappropriate, and even stupid. The proper sequence of events should have been to give all the crew (including the officers, who are the worst of the lot as far as fitness is concerned) adequate training before the trial was undertaken, so that they might be brought up to standard. Instead, a silly test was administered, and when the sailors died they simply cancelled all running - creating a Catch 22 situation.

Another example was the late Alan Brown, an intelligent Bank Manager from New Zealand, who was trying very hard to beat me in Orienteering. He started a race shortly after a "civilised" breakfast, but in the forest 200 metres after the start, he became sick, and choked to death. Again I had tried to advise him, but he too would not listen. You must leave at least two hours between finishing a meal and starting a run.

Errors Specific To Diet

ANOREXIA - It is not uncommon for college teams in the US to insist that their girls control their weight by dieting, without correct nutritional guidance; the scales being the only criterion. The result is that some young women stop eating to "make the weight" whenever they are tested. A weakened condition caused by not eating enough nutritious food can lead to many problems, sickness and even broken bones. Female runners should instead aim to get faster by getting stronger and healthier with hard training and eating nutritious foods and taking vitamin supplements.

SPORTS ANAEMIA - This is another common problem amongst athletes who train hard which is likely to be caused by poor nutrition. Without proper nutrition, it is impossible to absorb the amount of iron necessary to carry out hard training day after day. Even if there is an abundance of iron available in the diet, inadequate nutrition may prevent the athlete from getting maximum iron absorption, and the blood count will plummet. Vitamin B₁₂ and folic acid (other haematinics) are also critical in such cases. Have a regular blood test to establish the level of haemoglobin in your body. Under a doctor's guidance, take iron supplements and improve your nutrition to raise your blood count, if necessary. If you are anaemic, don't look for a miracle cure. It can take as long as six months to improve your blood count - if you take it easy. It may be necessary to take a period of rest while you rebuild your blood. Then resume training as a healthier person. If you continue to train hard you are likely to have a greater set-back.

Once again, it is important to work on this problem with a physician who is aware of the needs of a training athlete. A doctor used to the "average" person will tell you that a blood count (i.e. haemoglobin level) of 12 g/dl is adequate. If you are going to be an athlete, it will need to be at least 14 g/dl! Kip Keino and Jim Ryun had blood counts of over 19 g/dl when they were running at their best.

Training at altitude will stimulate the body to develop a higher blood count due to the lack of oxygen in the air (which increases the secretion of a hormone called erythropoietin, leading to a stimulation of the bone marrow to produce more red blood cells). Athletes training at higher altitudes will therefore need to supplement their diet more, due to the increased demands that this type of training makes on the body. American Bill McChesney told me that he could not run consistently hard at high altitude - he had to resort to swimming and cycling, in lieu of running, to keep his muscles going. If he had improved his nutrition while training at altitude, he would have found he could have trained very effectively, and perhaps would even have regained his position as national champion and record-holder.

Finally, avoid the use of antibiotics. When you put these substances into your body, you destroy many of the good qualities you have built up with proper nutrition and hard training. Antibiotics are a last resort life-and-death treatment. If you take them, rest afterwards. Do not exercise for a week. Anne Audain made a dangerous error on three different occasions, when she attempted to run hard after receiving antibiotic injections. She did not tell me she had received an injection - had I known, I would have stopped her from running for several days. Anne collapsed after a hard training session at the Otahuhu track on that Tuesday, and collapsed again during a major championship race four days later. Subsequently, she was ill for a couple of weeks.

The same rule applies to surgery. The knife is meant to be used in extreme cases. Surgeons are for bed-ridden people on their last legs. Avoid the knife if at all possible.

I have found that the following books contain information you may find useful. You will find contradictions from one book to the next, but each of these publications contains the basics that you will need to know in order to make effective use of diet and vitamin supplementation, and thus maximise your level of health and athletic performance:

Eat To Win, by Dr. Robert Haas.

The Complete Guide to Health and Nutrition, by Gary Null.

A Guide to Vitamins, by John Marks.

The Vitamin Bible, by Earl Mindell.

Eating to Win - Food Psyching for the Athlete, by Francis Sheridan.

Your Personal Vitamin Profile, by Dr. Michael Colgan.