THE THEORY AND PRACTICE OF MIDDLE AND LONG DISTANCE RUNNING

Ian Harries (B.A.A.B. Senior Coach)

Moray House College of Education

Edinburgh, Scotland

THE THEORY AND PRACTICE OF MIDDLE AND LONG DISTANCE RUNNING

Being a dissertation presented in conjunction for the Diploma in Sports Coaching at Moray House College of Education (Incorporating the Scottish Centre for Physical Education, Movement and Leisure Studies).

I.L. HARRIES

September, 1987.

Acknowledgements.

I would like to thank the following people and organisations for making my presence on the course and the submission of this dissertation possible.

The Vice-Chancellor, Registrar and Staff of the Sports Section at the University of Zimbabwe;

Chibuku Breweries Limited;

Lonrho (Zimbabwe) Limited;
CALTEX OIL ZIMBABWE (PVT) LTD
Blue Ribbon Foods Limited;

My wife, Christine, and two children, Gemma and Simon, for their support;

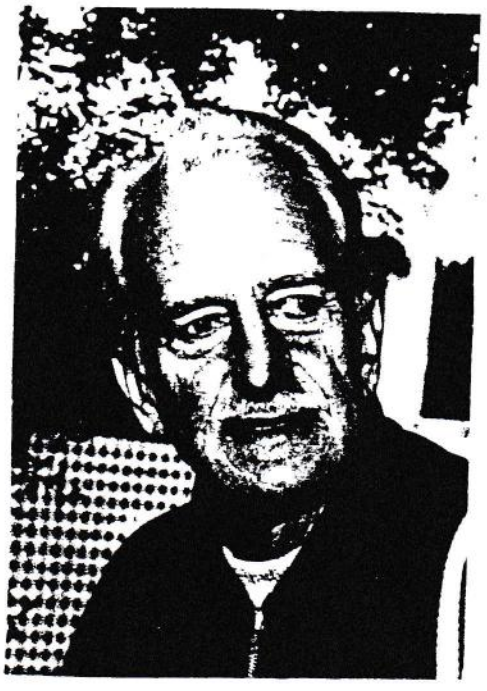
The Course Tutor, Mr John Lyle, and the various Lecturers on the Diploma in Sports Coaching course at Moray House College of Education in Edinburgh;

Mr David Lease, B.A.A.B. National Coach to the Scottish Amateur Athletic Association; and

The Amateur Athletic Association of Zimbabwe.

The Author would like to acknowledge the inspirational effect that the late

PERCY WELLS CERUTTY



had in rekindling his interest in Athletics and in particular Endurance Running during June 1967.

Abstract.

The Physique of the Elite Athlete looks at the various physical characteristics, both male and female, from the 800m to the Marathon including the Steeplechase. Somatotyping and measurements are provided from the work of Tanner (1964) and Watson and Pyke (1978).

The Energy Systems and their Training Effects deals in some detail with the anaerobic and aerobic systems and how they contribute to the various running events. The overlap of the two systems and the training ratios as they relate to the events are illustrated together with a listing of the biochemical changes that occur as a result of training.

The Training Systems discuss factors effecting endurance and what the various characteristics are in a physical context for each of the middle and long distance events. The aerobic and anaerobic training zones in terms of the two thresholds including maximum heart rate are explained along with the different training methods ie continuous, mixed, intermittent and competition/testing method. An overview is provided of all the different training methods and how they relate to the East German (Schmolinsky) classifications. A summary of the East German classifications is also provided.

The Planning of the Training Programmes deals with the training units, micro and macrocycles and the annual periodised year, how they are structured and how they might be varied. A separate section is devoted to marathon preparation where two, perhaps three, peak performances might be required in a single year. This is followed by an explanation of long term planning in terms of the mono and bicyclic approach.

The Nature of the Training Schedules provides examples from the training schedules of elite athlete thus illustrating the type of training undertaken for each of the individual events. It also provides the link between the ideal model theorised in the previous Chapter and the practicalities faced by these athletes.

Table of Contents.

	Title	I
	Acknowledgements	II III
	Abstract	IV
	Table of Contents	V
Chapter 1	Introduction and Objectives	6 - 8
Chapter 2	The Physique of the Elite Athlete	9 - 22
Chapter 3	The Energy Systems and their Training Effects	23 - 30
Chapter 4	The Training Systems	31 - 48
Chapter 5	The Planning of the Training Programme	49 - 70
Chapter 6	The Nature of the Training Schedules	71 - 95
Chapter 7	Conclusions	96 - 97
Chapter 8	Bibliography	98 - 100

Chapter 1

Introduction and Objectives.

Middle and Long Distance Running is a very well documented subject. However, it may be that very few of the more popular and readily available publications draw together the many different facets of the sport with sufficient detail and explanation.

The object of this dissertation is to present those areas of the subject that may need greater explanation. The Author has used a variety of sources for this purpose. This may well be the problem with endurance running literature in that the information is readily available but the researcher is forced into a situation whereby too many publications and journals have to be consulted.

In particular this dissertation will look at, in some detail, the physique of the elite athlete and the different aspects involved in the planning of the training programme. The greater number of the existing publications would appear to avoid dealing with either subject in any great depth. For example many of the existing books on endurance running tend to reproduce the actual training sessions of the elite athlete whilst avoiding explanation, in any great depth, of the theories behind the structure of the training unit, microcycles, macrocycles, the annual periodized training year and the relative intensities and volume of training over this period. It is hoped that this dissertation may help bridge some of that gap.

The value of this dissertation will be felt by the Amateur Athletic Association of Zimbabwe and will lay the basis for the first text of its kind within their Coach Education programme. It is hoped that the example displayed here will encourage other Zimbabwean coaches to make similiar contributions within their own respective disciplines. It is hoped that the text will also make some contribution to the existing British Amateur Athletic Board publications on endurance running.

The compilation of this dissertation has drawn heavily on work already produced by the coaching staff of the B.A.A.B. ie Dick, Brook, Wilson etc whilst reinforcing it with additional material from Bompa, Schmolinsky, Watson and Pyke. It was seriously felt that much of the work produced by the East Germans was, in some instances, confusing to the average coach in terms of their theories and terminology. Consequently an attempt has been made in Chapter 5

to summarise Schmolinsky and provide an overview of the existing training methods and terminology.

Athletics in the modern day context is extremely competitive. The athlete may be drawn into a situation whereby commercial interests or prize money are the primary considerations. For others it may be a question of status and the achievement of major championship honours. Irrespective of the motivating factors the intensity of the sport is higher than it has ever been before in its history. In some instances mere hundredth's of a second may differentiate between success and failure. It is hoped that this dissertation will provide an in-depth analysis and service to athlete and coach alike of the current theories to be found in endurance running literature.

Chapter 2

The Physique of the Elite Athlete.

2.1 The Physical Characteristics.

2.2. Mean Values of Measurements of Elite Runners from the 1956 Olympic Games in Rome.

2.3 The Somatotyping of the Elite Runner.

2.4 The Physical Differences between White and Negroid Athletes.

2.5 Average Values in terms of Age, Height and Weight for the Male and Female Olympic Finalists (1976/1980/1984) in all Events from 800m to the Marathon and from the 30 Leading Contenders for the 1987 World Championship Marathon in Rome.

2.6 Conclusions.

Harry Wilson in describing Nadezha Olizarenko following her Olympic win at 800m in the 1980 Olympic Games described her as a 'super' athlete with an ideal build. He qualified this 'ideal' build as being wide shoulders and narrow hips. However, on closer study, the question of physique is a little more complex.

2.1 The Physical Characteristics.

In observing the physique of the elite runner from 400m to the Marathon there is a clear continuum with the 1500m/5000m in the middle (Tanner 1964). 400m runners tend to be large, long legged, broad shoulders in relation to their hips and fairly heavily muscled. In contrast their long distance counterparts are smaller, short legged, narrow shoulders and relatively lacking in muscle.

It is clear that the long distance runner derives some advantage from having slender muscles for physiological rather than mechanical reasons. With a smaller body less energy is required to 'cruise' depending on the physiological and mechanical demands of the event.

There is also an obvious gradient in muscle size between the 1500m runner and the Marathoner. It is accepted that whilst there was a necessity to retain a balance in size the ability and need to sprint is associated with larger muscles.

2.2 Mean Values of Measurements of Elite Runners from the 1956 Olympic Games in Rome (Tanner 1964).

This study involved 47 middle and long distance runners all of whom qualified by performance before being examined. The study is further broken down along ethnic lines ie White, Negroid and Asians. The breakdown and qualification times are reflected in Table 1 (from Tanner 1964 pp 22).

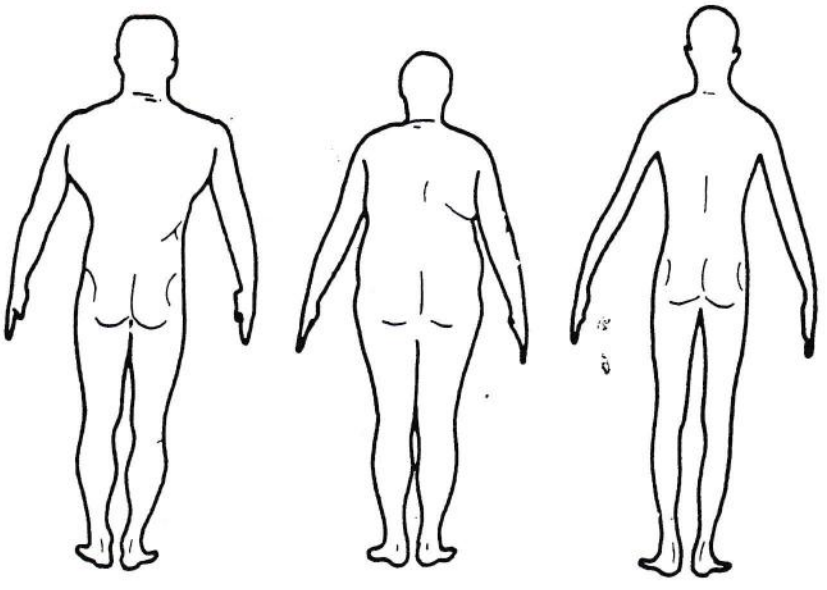
The mean values of measurements of the athletes in each of the middle and long distance running events along ethnic lines are reflected in Table 2 (from Tanner 1964 pp 52-53).

Event	Total	Whites	Negroid	Asians	Qualification Time
800m					1:49.2
1500m	16	16	0	0	3:45.0
Steeplechase	4	4	0	0	-
5000m					14:10.0
10,000m	21	19	2	0	29:40.0
Marathon	10	9	0	1	2:30:00

Table 1 - Ethnic Breakdown and Qualification Times of Athletes Examined (Tanner 1964).

2.3 The Somatotyping of the Elite Runner.

The three dominant physique patterns or body types are reflected in Figure 1 (Watson and Pyke 1978).



A MESOMORPHIC PHYSIQUE TYPE

AN ENDOMORPHIC PHYSIQUE TYPE

AN ECTOMORPHIC PHYSIQUE TYPE

Table 2 (from Tanner 1964 pp 52-53)

Mean Values of Measurements *of Athletes in Each Event, Whites*

Events	No.	Stature	Sitting Height	Leg length (sub-ischial)	Arm length	Shoulder width (biacromial)	Hip width (biiliac)	Elbow width (bicond. hum.)	Knee width (bicond. fem.)	Upper arm circ.	Thigh circ.	Sum of skinfold transforms	Trans. waist	A.P. waist	Body weight	X-ray Measurements: Arm fat	Arm bone	Arm muscle	Calf fat	Calf bone	Calf muscle	Thigh fat	Thigh bone	Thigh muscle
		cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	units	cm.	cm.	kg.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
800/1,500 m	16	180·5	92·8	87·7	79·8	41·4	29·3	7·01	9·58	27·0	53·0	56·8	26·9	19·9	68·9	0·53	2·23	6·76	0·50	2·95	8·62	0·73	3·45	14·4
5,000/10,000 m	19	174·4	91·2	83·2	77·0	39·2	28·1	6·95	9·49	25·2	50·5	53·1	25·8	18·8	60·8	0·52	2·14	6·33	0·51	2·75	8·58	0·67	3·16	13·7
Marathon	9	171·1	89·5	81·6	75·9	39·8	28·3	6·79	9·58	24·9	49·9	53·2	26·4	19·1	59·9	0·55	2·16	6·16	0·52	2·92	8·22	0·72	3·33	13·2
Steeplechase	4	179·2	93·0	86·2	78·9	40·7	28·9	7·13	9·85	24·9	50·1	51·8	26·0	19·6	64·8	0·50	2·30	6·25	0·41	2·87	9·28	0·66	3·30	13·8

Mean Values of Measurements *in Each Event, Negroes*

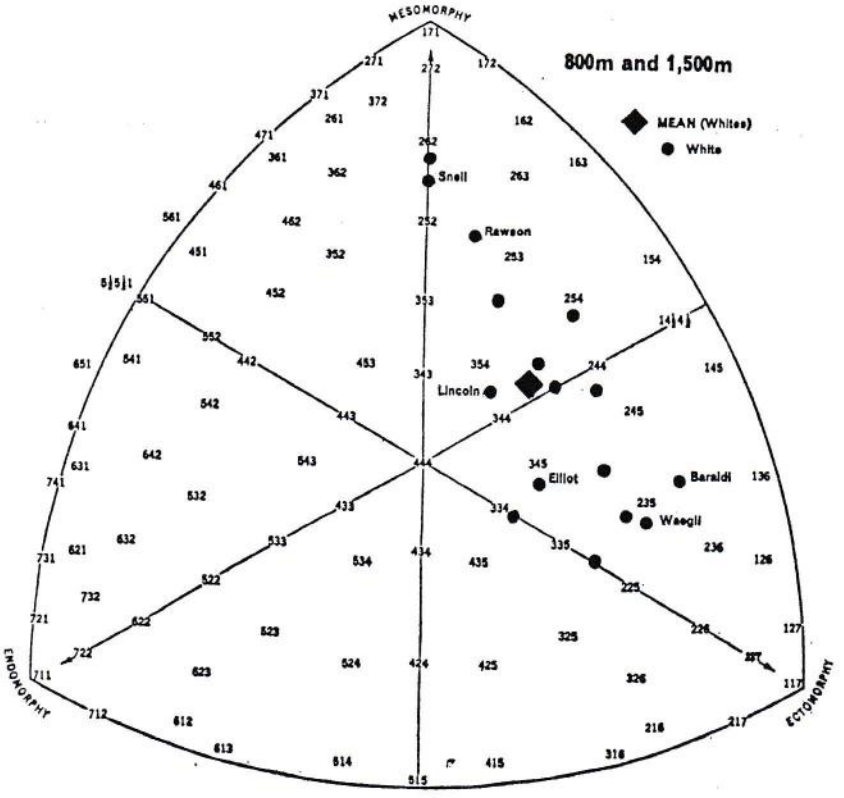
Events	No.	Stature	Sitting Height	Leg length (sub-ischial)	Arm length	Shoulder width (biacromial)	Hip width (biiliac)	Elbow width (bicond. hum.)	Knee width (bicond. fem.)	Upper arm circ.	Thigh circ.	Sum of skinfold transforms	Trans. waist	A.P. waist	Body weight	X-ray Measurements: Arm fat	Arm bone	Arm muscle	Calf fat	Calf bone	Calf muscle	Thigh fat	Thigh bone	Thigh muscle
		cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	units	cm.	cm.	kg.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
5,000 m	2	174·5	89·6	84·9	78·1	38·9	25·9	6·90	9·40	26·6	51·7	58·3	25·7	19·8	62·9	0·50	2·24	6·60	0·56	3·15	7·95	0·64	3·14	14·6

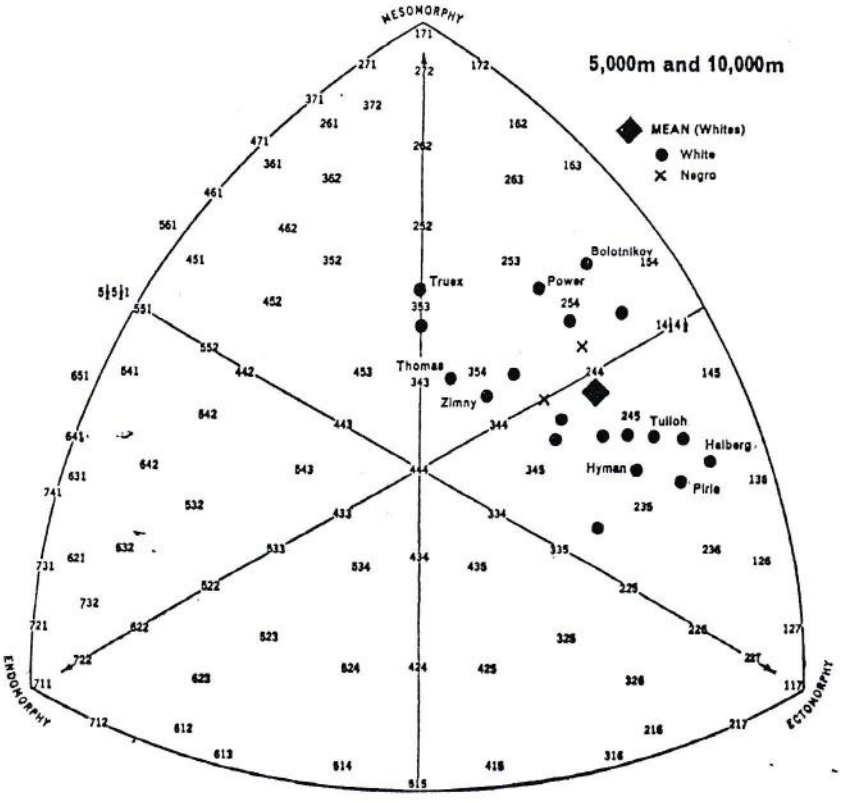
Mean Values of Measurements *in Each Event, Asians*

Events	No.	Stature	Sitting Height	Leg length (sub-ischial)	Arm length	Shoulder width (biacromial)	Hip width (biiliac)	Elbow width (bicond. hum.)	Knee width (bicond. fem.)	Upper arm circ.	Thigh circ.	Sum of skinfold transforms	Trans. waist	A.P. waist	Body weight	X-ray Measurements: Arm fat	Arm bone	Arm muscle	Calf fat	Calf bone	Calf muscle	Thigh fat	Thigh bone	Thigh muscle
		cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	units	cm.	cm.	kg.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
Marathon	1	170·5	93·5	77·0	74·1	40·2	28·8	7·00	9·40	25·2	50·1	53·3	26·0	18·5	61·1	0·46	2·19	5·90	0·70	2·78	9·26	0·39	3·32	13·9

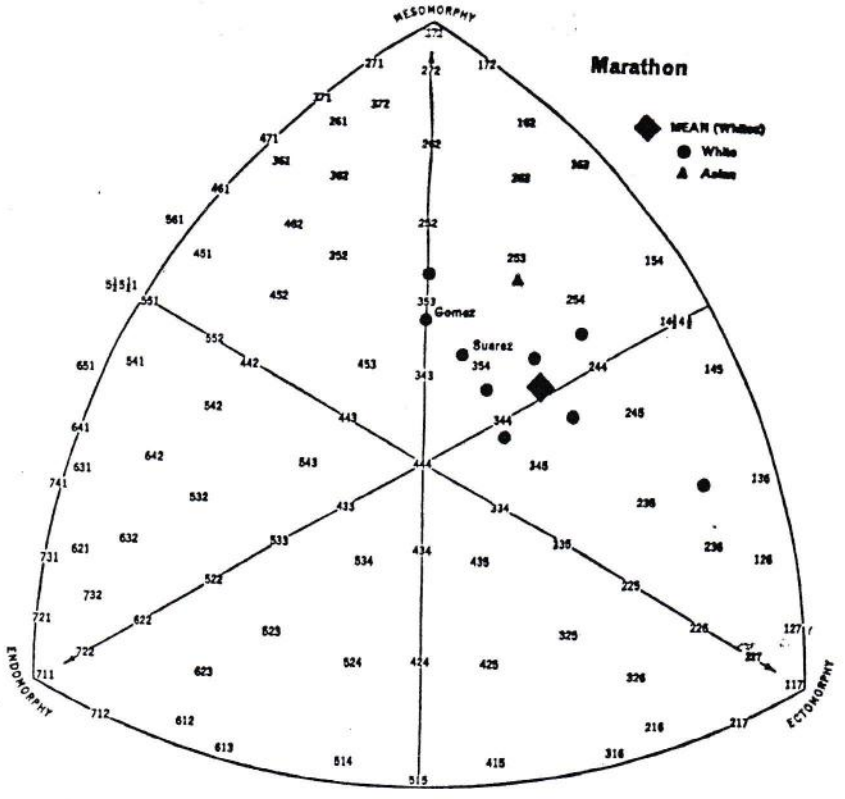
The following somatotyping (Tanner 1964) was concluded using the Sheldon 1940-54 technique from the athletes reflected in Table 1 and involves all three ethnic groups.

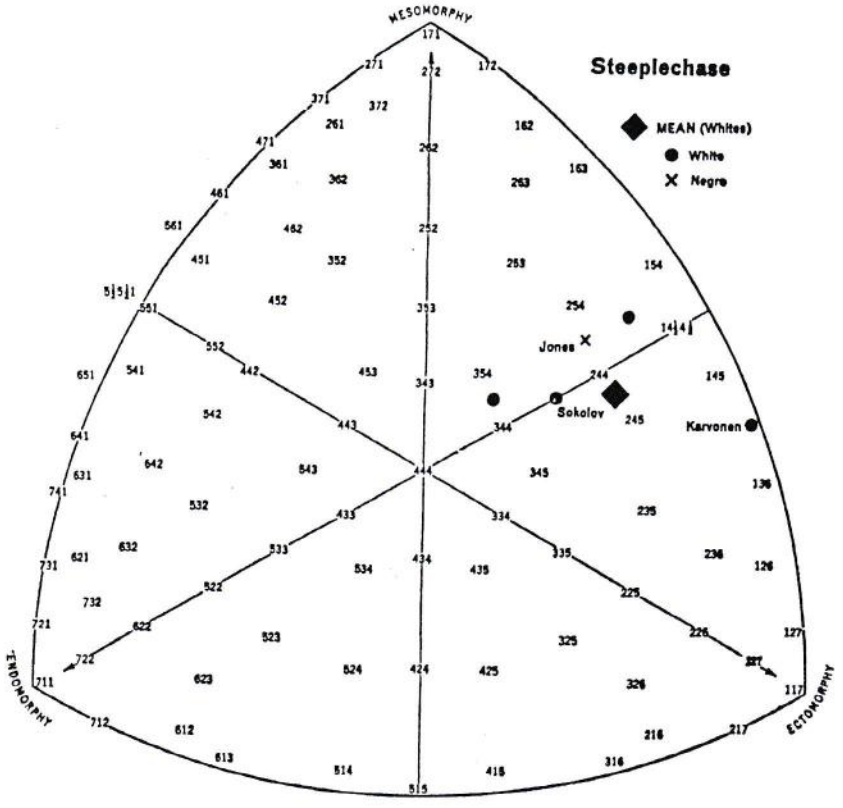
Figures 2 and 3 hereunder, as indicated, are from Tanner 1964 pp 43.





Figures 4 and 5 (from Tanner 1964 pp 44).





The mean values of this somatotyping broken down into the three body types are reflected in Table 3 (from Tanner 1964 pp 53).

For Whites	Somatotype Endomorphy	Mesomorphy	Ectomorphy
800/1500m	2.56	4.34	4.31
5000/10,000m	2.16	4.18	4.26
Marathon	2.61	4.39	3.94
Steeplechase	2.00	4.13	4.50
For Negroids			
5000m	2.50	3.75	4.00
For Asians			
Marathon	2.00	5.00	3.00

Using Tanner (1964) and data from de Garay, Levine and Carter's analysis of elite athletes competing in the 1968 Olympic Games in Mexico City the following conclusions were reached. It should be noted that the somatotyping figures are arrived at through a different and more up to date method than Tanner's previous figures. Somatotyping and comment follow in Table 4 (from Pyke and Watson 1978 pp 44).

TRACK EVENT AND REPRESENTATIVE SOMATOTYPE

Event	Average Representative Somatotype			Comments
Sprint 100 m/200 m	2	5½	3	High in mesomorphy, low in ectomorphy and endomorphy
400 m	2	4½	3½	Higher ectomorphy, lower mesomorphy than sprint type
Middle-distance 800 m/1500 m	2	4½	4	Higher ectomorphy than 400 m
Long-distance 5000 m/10000 m	2	4	4	Low endomorphy and lower mesomorphy than middle distance type
Marathon	2	4½	3½	Shape closest to 400 m runner but size very much smaller

The average somatotyping within the 1500/5000m/Marathon competitors was approximately 2½ 4 4. It was found that the Steeplechasers were also close to the average. There was no indication that winning was

associated with the position in the somatotype distribution for the event, unless it be further from rather than nearer to the mean. The physiques of Snell, Juantorena and Coe will illustrate this.

2.4 The Physical Differences between White and Negroid Athletes.

Tanner (1964) concluded from his observations that where the Negroid athletes appeared outstanding in certain events they displayed the following physical differences, on an average, over their White counterparts. They had longer arms and legs, narrower hips, smaller calf muscles, wider tibia and slightly more muscle in the arms and thighs.

Their power to total weight ratio at any given size was better and overall they derived certain mechanical advantages for the explosive events.

Under the present economic and social circumstances there was probably stronger pressure for an ambitious and talented Negroid athlete to enter competitive athletics than his White counterpart. The restriction of the Negro athlete to the sprints, hurdles, jumps and decathlon may be more because of tradition than anything else. At the time of Tanner's study the East Africans were becoming increasingly successful at the middle and long distance running events and the West Africans the shorter, more explosive, running events.

2.5 The Average Values in terms of Age, Height and Weight for the Male and Female Olympic Finalists (1976/1980/1984) in all events from the 800m to the Marathon and from the 30 Leading Contenders for the 1987 World Championship Marathon in Rome (from Watman 1987 in Athletics Weekly).

Table 5, researched by the Author, reflects an extensive study undertaken of the Mens and Womens performances in all the middle and long distance events in the 1976, 1980 and 1984 Olympic Games. The study is restricted to finalists only. Together with the performance data information has been collected on their age, height and weight and the averages (Av1) worked out. Av2 is an average of the figures reflected in Av1 ie the 800m average of 1:45.82 (Av2) is an average

Table 5

Average Mean Values for Age/Height/Weight and Performances for Male/Female Olympic Finalists in 1976/1980/1984 (after the Scottish AJCC 1976 and BAAB 1980/1984 Technical Olympic Reports).

				TIMES				AGE				HEIGHT				WEIGHT			
Event	Yr	M/W	No	Fastest	Slowest	Av1	Av2	Old	Yng	Av1	Av2	Tall	Shrt	Av1	Av2	Hvt	Lgt	Av1	Av2
800m	76	M	8	1:43.50	1:48.39	1:45.26		27	20	23.5		1.91	1.75	1.82		84.0	59.0	70.5	
	80	M	8	1:45.4	1:49.3	1:46.7		29	24	26.6		1.93	1.75	1.82		75.0	54.0	65.9	
	84	M	8	1:43.00	1:52.28	1:45.51	1:45.82	28	20	23.1	24.4	1.91	1.70	1.82	1.82	77.0	60.0	71.2	69.2
	76	W	8	1:54.94	2:02.21	1:57.07		27	20	22.8		1.72	1.62	1.65		61.0	46.0	54.0	
	80	W	8	1:53.5	1:59.2	1:56.7		29	22	25.4		1.73	1.64	1.68		61.0	52.0	56.4	
	84	W	8	1:57.60	2:00.77	1:59.49	1:57.75	33	20	25.1	24.4	1.77	1.60	1.68	1.67	61.0	46.0	53.9	54.8
1500m	76	M	9	3:39.17	3:43.02	3:40.37		28	22	24.5		1.91	1.70	1.79		76.0	59.0	65.9	
	80	M	9	3:38.4	3:43.1	3:40.4		31	19	24.1		1.85	1.70	1.79		71.0	54.0	64.7	
	84	M	8	3:32.53	3:37.11	3:35.24	3:38.67	28	23	25.2	24.6	1.86	1.70	1.79	1.79	72.0	60.0	66.1	65.6
	76	W	9	4:05.48	4:09.55	4:07.18		32	19	24.7		1.72	1.58	1.66		61.0	44.0	52.9	
	80	W	9	3:56.6	4:04.8	4:00.60		38	23	27.5		1.72	1.64	1.67		60.0	49.0	54.1	
	84	W	8	4:03.25	4:08.92	4:05.09	4:04.29	34	23	27.6	26.6	1.77	1.60	1.71	1.68	61.0	48.0	54.7	53.9
3000m	84	W	8	8:35.96	8:51.53	8:44.03	8:44.03	34	18	26.5	26.5	1.70	1.54	1.62	1.62	53.0	42.0	48.8	48.8
3000mSC	76	M	12	8:08.02	8:42.74	8:20.73		30	21	24.6		1.86	1.70	1.77		74.0	57.0	67.1	
	80	M	8	8:09.7	8:19.8	8:15.9		29	22	24.5		1.82	1.65	1.76		68.0	53.0	62.4	
	84	M	8	8:11.80	8:21.51	8:15.64	8:17.42	30	22	25.3	24.8	1.86	1.62	1.75	1.76	73.0	54.0	64.0	64.5
5000m	76	M	13	13:24.76	13:46.61	13:30.67		30	21	26.1		1.91	1.68	1.79		78.0	54.0	64.8	
	80	M	8	13:21.0	13:24.1	13:22.6		33	24	26.3		1.82	1.62	1.72		74.0	53.0	60.2	
	84	M	8	13:05.59	13:24.46	13:14.33	13:22.53	32	19	25.1	25.8	1.84	1.67	1.77	1.76	77.0	55.0	66.0	63.7
10,000m	76	M	14	27:40.38	29:17.74	28:14.20		36	23	27.1		1.82	1.67	1.74		68.0	52.0	61.0	
	80	M	8	27:42.7	28:11.0	27:54.5		35	21	26.7		1.83	1.20	1.67		63.0	45.0	57.0	
	84	M	8	27:47.54	28:28.08	28:09.89	28:06.20	32	22	27.2	27.0	1.84	1.72	1.78	1.73	68.0	53.0	60.0	59.3
Marathon	76	M	12	2:09:550	2:16:332	2:13:308		31	21	26.3		1.91	1.68	1.74		67.0	54.0	58.7	
	80	M	10	2:11:030	2:14:310	2:12:290		31	22	26.7		1.82	1.66	1.73		70.0	56.0	61.0	
	84	M	8	2:09:210	2:11:390	2:10:420	2:12:139	37	27	31.0	28.0	1.80	1.69	1.75	1.74	70.0	52.0	60.9	60.2
	84	W	8	2:24:520	2:29:090	2:27:400	2:27:400	30	24	29.0	29.0	1.72	1.57	1.66	1.66	54.0	46.0	50.2	50.2

Reflected hereunder are facts and figures compiled by Mel Watman relating to 30 runners who look on their best form capable of bidding for medals in the 1987 World Championships Marathon in Rome.

Table 6 (from M. Watman, Athletics Weekly Vol 41 No 19 9/5/87).

	Name	Country	Age	Height	Weight
Men					
1	Mekonnen	Eth	24	1.58	59
2	Densimo	Eth	29	-	-
3	Beursken	Neth	35	1.65	45
4	Borain	Ita	28	1.83	68
5	de Castella	Aus	30	1.80	70
6	Ikangaa	Tan	29	1.63	58
7	Itoh	Jap	32	1.63	53
8	Ivanova	USSR	35	1.64	52
9	Jones H	GB	31	1.79	60
10	Jones S	GB	31	1.78	61
11	Kodama	Jap	28	1.65	49
12	Lopes	Por	40	1.67	56
13	Nakayama	Jap	27	1.80	58
14	Pizzolato	Ita	28	1.79	61
15	Robleh	Dji	29	1.69	52
16	Salah	Dji	31	1.80	60
17	Seko	Jap	30	1.70	59
18	Spedding	GB	35	1.74	63
19	Treacy	Ire	29	1.75	59
		Averages :	30.6	1.72	57.9
Women					
1	Dorre	GDR	25	1.70	55
2	Pogli	Ita	27	1.68	50
3	Heilman	GDR	25	1.74	55
4	Kristiansen	Nor	31	1.70	50
5	Lelut	Fra	31	1.58	45
6	Marot	GB	31	1.68	52
7	Martin	Aus	27	1.66	47
8	May-Edge	Can	27	1.63	48
9	Moller	NZ	31	1.74	58
10	Mota	Por	28	1.57	45
11	Waitz	Nor	33	1.72	52
		Averages :	28.7	1.67	50.6

of the 1976/1980/1984 averages. The figures in Table 5 specifically underlined have been transferred to Table 7 showing a graph of these figures including the Marathon statistics from Table 6 of 30 of the leading contenders in contention for the 1987 World Championship title. All the figures within the graphs depict the difference between male and female performers. In effect the longer the running event the lighter, shorter and older competitors tend to become.

A further interesting exercise is to establish the athletes weight/height ratio by giving a percent of kilograms for every centimetre in height. This is done by dividing the height (in cms) into weight (in kgs) ie

Los Angeles Olympic Games 1984

	800m	1500m
Men	0.38	0.37
Women	0.33	0.31

In analysing the figures and tables supplied in this Chapter it should be remembered that the 3000m and Marathon events for women were first introduced into the Olympic Games in 1984. Also that the information will have been effected by the African boycott (1976), the Western boycott (1980) and the Eastern Bloc boycott (1984).

The following data (from Pyke and Watson 1978 pp 45) supplies additional material on body size and composition and further illustrates the inter-event differences. Their data was obtained from Tanner (1958 and 1960) and de Garay, Levine and Carter (1968 Olympic Games).

An interesting inclusion here is the Lower Extremity Length/Trunk Length index. A higher ratio/index indicates a relatively long leg and the highest figures were found in the 400m and 1500m competitors. The 100m runners have relatively short legs and the Marathoners have the shortest legs of all. There is some confusion in the diagram (the third of the three) as the Marathon figure does not reflect this.

The three graphs hereunder show the average values in terms of Age/Height/Weight for Males/Females in three Olympic Finals (1976/1980/1984) in all events from the 800m to the Marathon. It also reflects the averages from the 30 leading contenders for the 1987 World Championship Marathon in Rome. The data is extracted from Tables 5 and 6.

Table 7 (compiled by the Author).

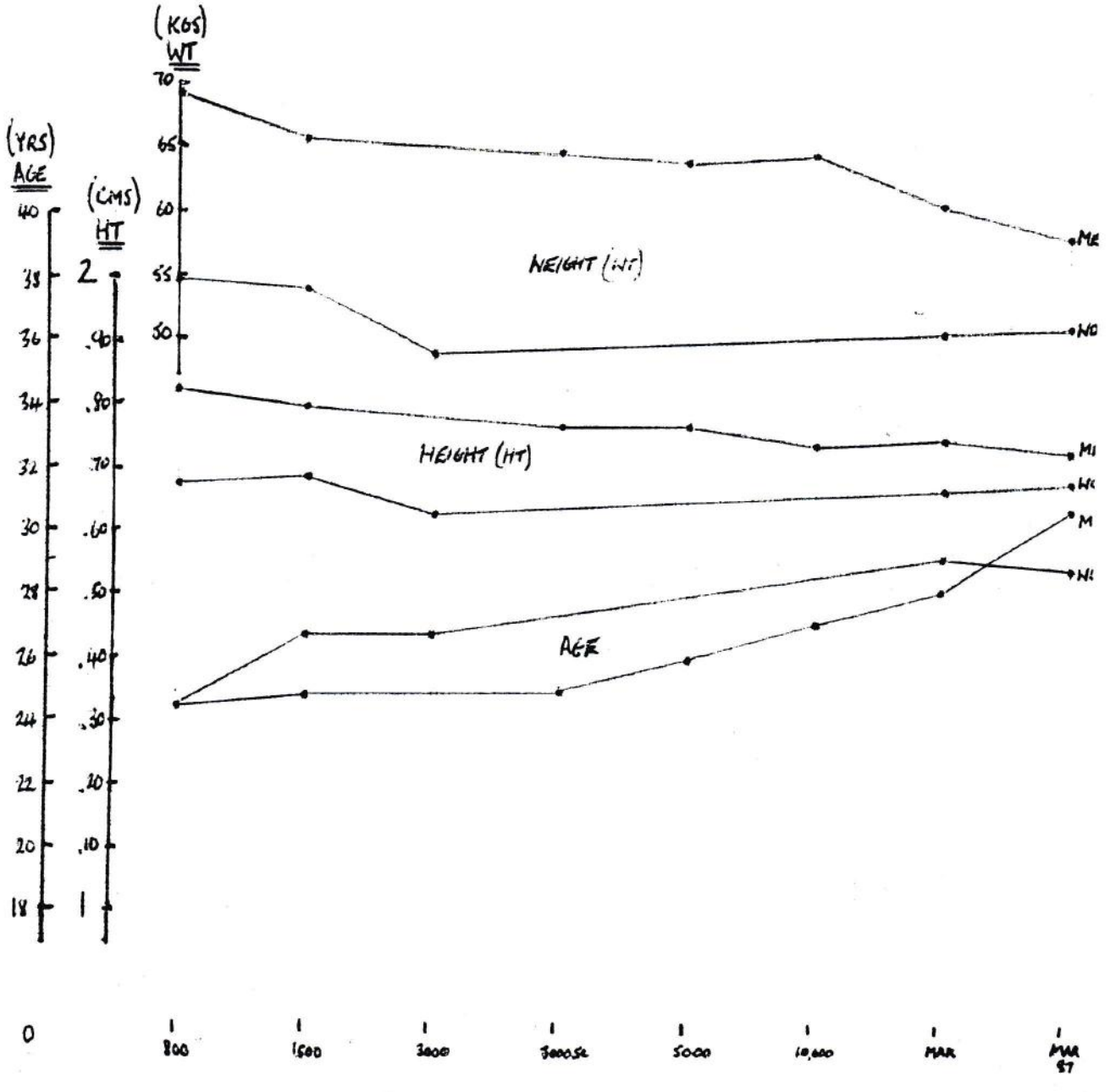
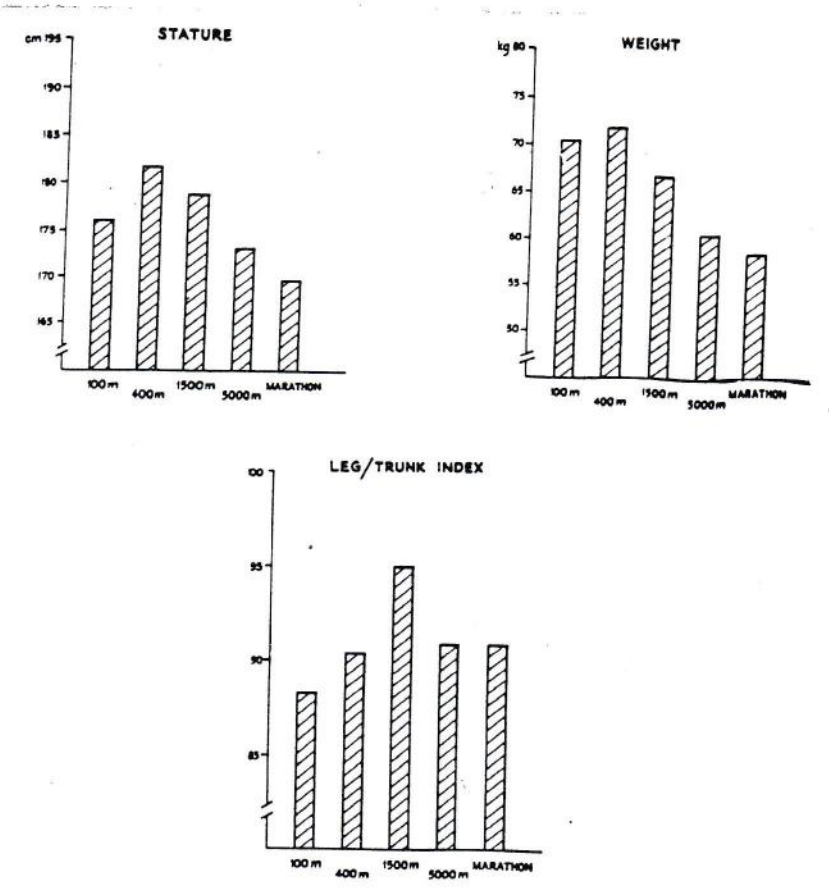


Figure 6 (from Pyke and Watson 1978 pp 45).



2.6 Conclusions.

Studies have shown that only half of the somatotypes of the general population are also shared by Olympic athletes. Middle and long distance athletes have shown that, by and large, they are neither extremely ectomorphic nor predominantly endomorphic.

The 400m and middle distance athletes are long legged and less muscular than sprinters but have heavier builds than the long distance athletes and marathoners. Female middle distance runners are similiar in build to the male long distance runner but different from their male middle distance counterparts. In general as the running events become less intense and more prolonged both male and female builds become lighter, more linear and less muscular. The light, linear build certainly predominates amongst the male long distance and marathon runners.

In respect of height the general finding is that runners are

shorter the longer the event. Weight follows a similiar trend with athletes becoming lighter the longer the event. The following figures (from Pyke and Watson 1978) illustrates this point.

	Height	Weight
400m	181.7	71.8
Middle-distance	178.9	67.0
Long-distance	173.2	60.3
Marathon	169.9	58.3

The above figures were obtained from the 1968 Olympic Games as was the fact that in terms of body composition sprinters carried the greatest percentage of body fat. Not surprisingly this descended on a sliding scale to the Marathoner. The trend was the same in women. The fact was however acknowledged that lean-ness may result from heavy training sessions involving 100+ miles per week.

Chapter 3

The Energy Systems and Their Training Effects.

3.1 The Anaerobic Systems.

3.1.1 The ATP-CP System.

3.1.2 The Lactic Acid System.

3.2 The Aerobic System.

3.3 The Overlap of the Two Energy Systems.

3.4 Training Ratios.

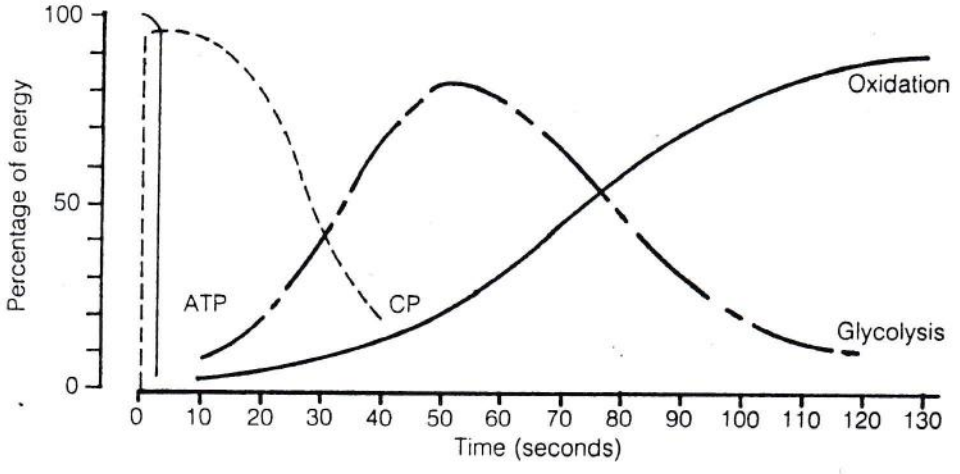
3.5 Training Effects.

The sun is the ultimate source of energy and it is through solar radiation that carbohydrates are formed in plants. Humans eat plants and animals for food thus deriving the energy used to manufacture adenosine triphosphate (ATP). This energy is required for all physical work including training, competition and the other biological processes thus allowing the muscle to convert this chemical energy into mechanical work.

More precisely energy is derived from the conversion of foodstuffs within the muscle cells to a high energy compound known as ATP. ATP is stored within these cells and is made up of one molecule of adenosine and 3 molecules of phosphate. Energy for muscular contraction is released by the conversion of ATP to adenosine diphosphate + one molecule of phosphate (ADP + P) ie as one phosphate bond is broken ADP + P is formed from ATP and energy is released. The store of ATP within the muscle is limited and must be continually replenished if physical work is to continue.

ATP supplies may be replenished by any one of three energy pathways depending on the type of activity undertaken. They are the (a) ATP-CP System (Creatine Phosphate); (b) the LA System (Lactic Acid) and (c) the 02 System (Oxygen). The following diagram illustrates the proportional contribution of the energy systems (Keul 1973 - quoted from Brook 1987 pp 14).

Figure 7 Proportional contribution of the energy systems.



The first two systems replenish the stores of ATP without oxygen

being readily available and is known as the Anaerobic (without oxygen) system and the third replenishes ATP in the presence of oxygen and is known as the Aerobic (with oxygen) system.

This process is expressed in the following equation.

ATP - ADP + P + Energy.

3.1 The Anaerobic Systems.

3.1.1 The ATP-CP System.

This system is also referred to as the Alactic Anaerobic Energy Pathway. As only small amounts of ATP are stored in the muscle the energy depletion is very rapid when work is performed at a high level. In response CP (Creatine Phosphate or Phosphocreatine), which is also stored in the muscle cells, is broken down into creatine and phosphate. This process releases energy which is used to resynthesize ADP + P into ATP which is again transformed into ADP + P causing the continual release of energy, whilst stores last, for the contraction of the muscles. CP broken down into C and P does not release energy that can be used directly for energy but is used to resynthesize ADP + P into ATP. Because of the limited stores this system can only be used for approx. 8-10secs (Bompa) or 10-15secs (Dick). It is the chief source of energy for the very quick, explosive events ie 100m, jumps and throws in athletics. There is 3-4 times the amount of CP as there is ATP in the muscle and approx. 25-30secs recovery is required to resynthesize half the CP/ATP stores. It is presently unclear whether training can improve this capacity (Dick).

The system can be expressed in the following equation.

ATP - ADP + P + Energy.
ADP + P (from CP) - ATP + Creatine.

3.1.2 The Lactic Acid System.

This system is also referred to as the (a) Lactic Anaerobic Energy Pathway or (b) Anaerobic Glycolysis and is used for events of a longer nature lasting up to approx. 40secs (Bompa) or 40-50secs

(Dick) still of a very intense nature ie 200m, 400m and the major part of an 800m. In the first instance the energy is provided by the ATP-CP system. The LA system breaks down the glycogen stored in the muscle cells and liver (rather than CP) releasing energy to resynthesize ATP from ADP + P. As there is no oxygen in the breakdown of glycogen the by-product lactic acid is formed. As the lactic acid accumulates the muscle fatigues leading to a cessation and a severely diminished capacity for physical work. An exposure to this type of training will increase the athletes ability to utilise this pathway.

The system can be expressed in the following equation.

Glycogen (1 unit) + P + ADP - ATP (3 units) + Lactate.

3.2 The Aerobic System.

This system is also known as the Aerobic Energy Pathway which requires about 2 minutes to start producing energy for the resynthesis of ATP from ADP + P. The heart rate and respiratory rate must be increased to a level sufficient to transport the required amount of oxygen to the muscle cells in order that glycogen may be broken down in the presence of oxygen. Glycogen is the source of energy used to resynthesize ATP in both the LA and oxygen systems. The oxygen system breaks down glycogen in the presence of oxygen thereby producing little or no lactic acid. Hence physical work can continue for a long period of time. This pathway involves the use of the whole of the oxygen transport system and the use of oxygen in the mitochondria in the muscle.

The aerobic system is the prime source of energy for events lasting from 2 minutes to 2-3 hours ie 1500m, 3000m Steeplechase, 5000m and 10,000m including much more prolonged work at lower intensity in the case of the Marathon. Physical work exceeding 2-3 hours may result in the breakdown of fats and protein when the glycogen stores near depletion.

In all these processes involving the breakdown of glycogen, fats and protein certain by-products are formed ie carbon dioxide (CO_2) and water (H_2O) and are expelled from the body through respiration (exhalation) and perspiration. The rate at which ATP is replenished

is limited by the athletes aerobic capacity or the maximum rate at which they can consume oxygen. The pathway can be developed through specific training.

The system can be expressed in the following equation.

Glycogen (1 unit) + P + ADP + O2 = ATP (37 units) + CO2 + H2O.
FFA (1 unit) + P + ADP + O2 = ATP (approx 140 units) + CO2 + H2O.

FFA or free fatty acids are the more favourable source of energy inhibited only by its poor rate of exchange when compared with glycogen.

3.3 The Overlap of the Two Energy Systems.

The energy sources are used and depleted according to (a) the intensity and (b) the duration of physical work. Except for the very short, explosive activities most running events employ, to varying degrees, both energy systems producing an overlap between the anaerobic and aerobic systems. The levels of lactic acid in the blood is a good indicator as to the intensity of the work. 4 millimoles of lactic acid usually indicates that both the lactic acid and oxygen systems are contributing to the resynthesis of ATP. Higher levels will involve the LA system and lower levels the oxygen system. This threshold may have an equivalent heart rate in the region of 168-170 BPM (beats per minute). Higher or lower rates will involve the previously indicated energy systems. These rates of work ie mmol of LA or heart rate are important when constructing training schedules as it is essential that the right energy system is stimulated at the appropriate time.

Research has shown that the splitting or contribution of each of the energy systems may even be 50/50 after approx. 60-70secs of work. Other research has shown that the aerobic system can make up to a 47% contribution at the end of 60secs of intensive work. The aerobic system has a dominant role to play in training for most events. A well trained aerobic system can (a) increase the total energy available even if the event is predominantly anaerobic and (b) provide the situation whereby an athlete undergoing anaerobic training will recover faster during the recovery phase. Therefore an increase in the total volume of work with emphasis on the aerobic

system is vital.

The 1500m is a good example of the blend between aerobic and anaerobic metabolism. The anaerobic system is stimulated in the fast start and finish of the race with the aerobic system predominatin during the middle or steady state period of the race.

3.4 Training Ratios.

In relating the energy pathways to performance it will, to some extent depend on how the race is run. The time of the performance is partly related to the energy system involved. Sometimes several energy systems are in operation at the same time. The following categories may be useful in identifying the various divisions with anaerobic and aerobic endurance (from Dick 1984 pp 47-48).

Short anaerobic	-25secs (mainly alactic)
Medium anaerobic	25-60secs (mainly lactic)
Long anaerobic	60secs-2mins (lactic/aerobic)
Short aerobic	2-8mins (lactic/aerobic)
Medium aerobic	8-30mins (mainly aerobic)
Long aerobic	30+mins (aerobic - subject to availability of fuel).

Table 8 illustrates the aerobic to anaerobic contribution to energy requirements according to the distance run (from Dick 1980 pp 207).

Distance (in meters)	Aerobic	Anaerobic
200m	5%	95%
400m	17%	83%
800m	34%	66%
1500m	50%	50%
5000m	80%	20%
10,000m	90%	10%
Marathon	98%	2%

Some coaches advocate that training should follow similiar ratios whilst others advocate that the individual events should be evaluated on their specific demands ie speed, speed endurance, stamina etc.

3.5 Training Effects.

The effects of training can best be categorized by classifying them as follows.

(i) Those occurring at tissue level ie biochemical changes;
(ii) those occurring systematically ie affecting the circulatory and respiratory systems including the cardio-vascular system; and
(iii) those changes concerned with body composition, blood cholestrol, blood pressure, troglyceride levels and changes in respect of heat acclimitization.

Training effects are specific to the type of training undertaken ie whether it is aerobic (endurance) or anaerobic (sprint). Information regarding the effects of training at the biochemical level are relatively new and not as consistently documented as those levels referred to in (ii) and (iii) above. This dissertation will address itself only to the biochemical changes a summary of which is listed hereunder (from Fox and Mathews 1981 pp 301).

Biochemical changes in skeletal muscle induced by physical training (the symbol + represents an increase).

(a) Aerobic Changes.

+ myoglobin content
+ oxidation of glycogen
    + number and size of mitochondria
    + activity of Krebs Cycle and the Electron Transport System
    + muscular stores of glycogen
+ oxidation of fats
    + muscular stores of triglycerides
    + availability of fats as fuel
    + activity of enzymes involved in activation, transport and breakdown of fatty acids

(b) Anaerobic Changes.

+ capacity of the ATP-CP system
    + muscular stores of ATP and CP
    + activities of the ATP turnover enzymes
+ glycolytic capacity
    + glycolytic enzyme activity

(c) Relative Change in Fast and Slow Twitch Fibres.

+ aerobic capacity equal in both fibres
+ glycolytic capacity greater in fast twitch fibre
  selective hypertrophy - fast twitch = sprint training
  slow twitch = endurance training
  no fibre type interconversion

The reader may wish to refer to other text to note the changes occurring in (ii) and (iii). Reference should be made to The Physiological Basis for Physical Education and Athletics (Fox and Mathews 1981), Sports Training Principles (Dick 1980) and A Scientific Approach to Distance Running (Costill 1979).

Chapter 4

The Training Systems.

4.1 Factors Effecting Endurance.

4.2 Fitness Characteristics per Event.

4.3 Competition Demands of the Endurance Events.

4.4 Aerobic and Anaerobic Training Zones.

4.5 The Endurance Training Methods.

4.5.1 Duration Method.

4.5.1.1 The Continuous Method.

4.5.1.2 Mixed Pace Method.

4.5.2 Intermittent Method.

4.5.2.1 Aerobic Intervals.

4.5.2.2 Anaerobic Repetitions.

4.5.2.2.1 Strength Endurance.

4.5.3 Competition and Testing Method.

4.6 Other Considerations.

4.7 An Overview of Endurance Training Methods.

The endurance of an athlete will depend on many inter-related factors and abilities. In the broadest terms there are two kinds of endurance namely (a) general and (b) specific. General endurance involves many muscle groups and systems whereas specific endurance is related to the specific demands of the event in terms of competition distance and the speed at which it is run. General endurance provides the base or foundation to an athletes overall training programme and help to (a) perform high volumes of work (b) overcome fatigue in competition of a long duration and (c) overcome fatigue faster after training and competition. In turn the stronger the specific endurance which is developed from a solid base of general endurance, the easier the athlete may overcome various training and competition stressors.

However the overall development of the basic physical characteristics is far more complex in the context of conditioning training. The following diagram illustrates the many facets and it is to the various endurance training methods that need to be employed that this chapter addresses itself.

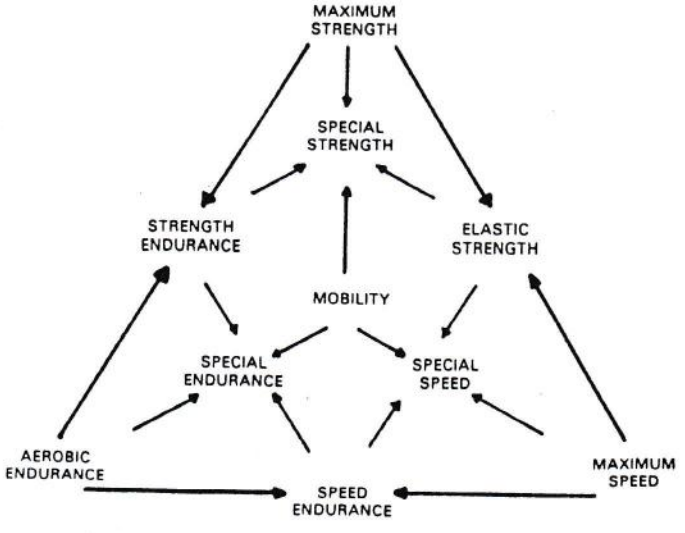


Figure 8 Schematic representation of the relationship of basic fitness characteristics and their involvement in the special fitness required of individual disciplines (from Dick 1984 pp 43).

4.1 Factors Effecting Endurance.

A number of factors will effect endurance performances and training will have to address itself accordingly during the general and specific components of the periodized year. They are (a) the central nervous system (b) athletic willpower (c) aerobic capacity (d) anaerobic capacity and (e) speed reserve.

(a) Fatigue impairs one's training efforts and effects the efficiency of the central nervous system (CNS). The CNS adapts to the demands of training and increases its working capacity. It improves the nervous connections for the well and co-ordinated functioning of the entire CNS in particular (i) the neuro-muscular co-ordination and (ii) the resistance of the nervous cell to stressful work.

(b) An objective during training should be to increase the athlete's tolerance to pain and the agony of training and competition. The athlete must learn to develop the desire and will to keep working during fatigue and even to increase it during the final stages of a race.

(c) The aerobic capacity is the ability to produce energy in the presence of oxygen and in the development of the oxygen transport system, the heart and in the utilization of oxygen at the muscle site. Research has shown that a high oxygen capacity transfers to anaerobic capacity in that an athlete may function longer before the onset of oxygen debt. The recovery thereafter is quicker. It also stablizes speed during the competition phase where the anaerobic capacity is utilised. It increases the durability of anaerobic power.

(d) The anaerobic capacity is the ability to produce energy in the absence of oxygen and is directly related to the intensity of the performance. It is effected by the CNS processes which allow the athlete to continue intensive work under exhausting conditions.

(e) The speed reserve is the difference between the fastest time achieved on a distance shorter than race distance and the time achieved over the same distance during a longer race. Tests should be conducted during the same period of time in order to be valid.

Athletes with higher speed reserves would spend less energy to maintain a given speed as compared to others with a lower reserve ie two 800m runners competing over that distance, one has a personal best performance of 50secs for the 400m whilst the other has a PB of 55secs. In the race they pass the bell (400m) together in 58secs. One has a speed reserve of 8secs whilst the other 3secs. It is unlikely that the athlete with the 3sec speed reserve will win the race.

4.2 Fitness Characteristics per Event.

It is important to appreciate how training methods are blended into the overall programme and into the sequence of annual training. The methods listed hereunder are placed into three categories ie General, Special and Competition Specific (from Dick 1984 pp 64).

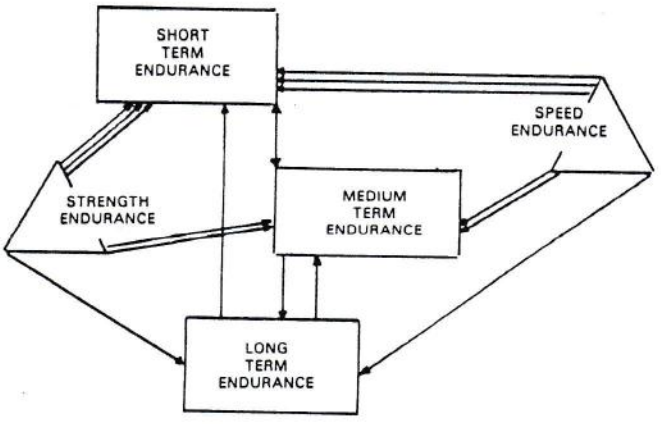
Event	General	Special	Competition Specific
Middle Distance	Aerobic Endurance Strength Endurance Mobility Maximum Strength	Speed Endurance Speed Elastic Strength Special Endurance (per distance)	Sprint Technique Time Trials Tactical Trials
Steeple-chase	Aerobic Endurance Strength Endurance Mobility Maximum Strength	Speed Endurance Speed Elastic Strength Special Mobility Special Endurance (per distance)	Hurdles Technique Waterjump Technique Sprint Technique Time Trials Tactical Trials
Long Distance	Aerobic Endurance Strength Endurance Mobility	Speed Endurance Speed Elastic Strength Special Endurance (per distance)	Sprint Technique Time Trials Tactical Trials

4.3 Competition Demands of the Endurance Events.

One school of thought holds that training percentages should be divided along the lines of the aerobic/anaerobic contribution to

the energy requirements for particular distances (see Table 8 on Page 28). Another school of thought holds that training should be evaluated on its demands relative to short, medium and long term endurance as well as speed/strength endurance (see Figure 9 hereunder). And yet a third school asserts that all the endurance events are based upon an extensive foundation of aerobic efficiency ie 67% of the training year is devoted to the duration methods, 20% to the specific demands and 13% to competition. Irrespective of these various schools of thought requirements will vary from individual to individual and will include such factors as the athlete's training status, their stage of development, the long and short term objectives, the athlete's personality, the limitations of the training environment and the other non-athletic demands on the athletes life.

Figure 9 illustrates the inter-relationship of the various areas of endurance (from Dick 1980 pp 209).



4.4 Aerobic and Anaerobic Training Zones.

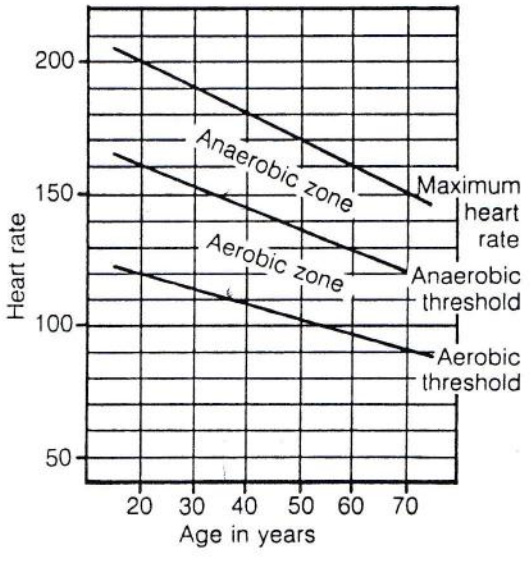
There is a linear relationship between heart rate and oxygen uptake. This provides a useful method of monitoring the pulse of the athlete following both a run and at the end of a recovery period. With the help of a Sports Tester the pulse can also be monitored during the run itself. Figure 10 on Page 36 provides a useful guide to training illustrating the maximum heart rate, the

anaerobic and aerobic thresholds. It should be noted that as age increases so all these values diminish. It would be valuable for the athlete to test his maximum heart rate at stages throughout his career along with other indicators provided in the following method.

Step 1 Establish the heart rate at rest;
Step 2 Establish the maximum heart rate following a run at either 300m or 800m;
Step 3 Establish the pulse range by subtracting (2) from (1); and
Step 4 Add to the figure arrived at in (3) $\frac{2}{3}$ of the resting heart rate.

In addition to the maximum heart rate the figure arrived at in (4) indicates to the athlete the pace at which he should run in order to achieve an aerobic training effect.

Figure 10 Aerobic and Anaerobic Training Zones (from Brook 1987 pp 18).



A further guide to training using heart rate might include the following using (a) a % as an expression of maximum heart rate (b) a related heart rate using, as an example, a maximum heart rate of 200 beats per minute (BPM) and (c) the training effect. The coach should always be asking why he is asking an athlete to perform a particular type of session and what he hopes to derive

from it given the nature of the overall programme. The estimates provided hereunder will be subject to variation between individual athletes.

Running at 60-80% (120-160BPM) of maximum heart rate (HR) would have the effect of stimulating the aerobic energy sources and pathways and utilising the slow twitch muscle fibres.

Running at 80-90% (160-180BPM) of maximum HR would stimulate the aerobic energy pathway and the anaerobic or lactate threshold using the slow twitch and FOG (Fast Oxidative Glycolytic) muscle fibres. The latter are thought to be able to convert from a fast twitch to a slow twitch function.

Running at 90-95% (180-190BPM) of maximum HR stimulates the anaerobic energy pathway using both the slow and FOG muscle fibres.

Running at 95-100% (190-200BPM) of maximum HR stimulates the anaerobic energy sources and pathways using both the slow twitch and fast twitch muscle fibres. It will also develop speed in terms of neuromuscular skill and efficiency.

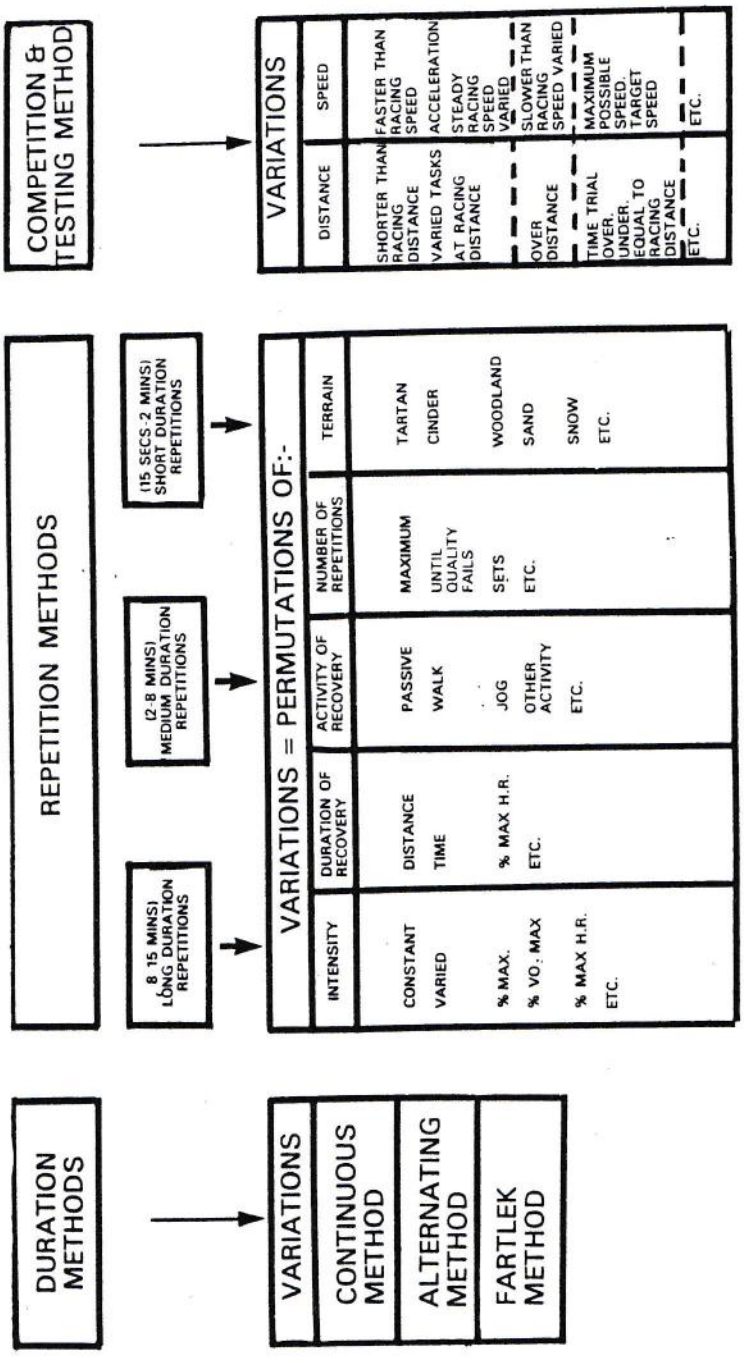
4.5 The Endurance Training Methods.

Using the traditional illustration (see Figure 11) provided by Harre (1973) wherein he summarises the endurance training methods the Author has combined this with Dick (1984), Schmolinsky (1978) and Brook (1987) to provide a clearer overall picture of the different training methods, the inter-relationship of short, medium and long term endurance combined with speed/strength endurance with examples of each (see Section 4.7 and the accomopanying fold-out illustrations at the end of this Chapter).

As a starting point Harre's overview is provided overleaf. However in one sense this illustration does not provide the student of Endurance Running with the overall picture ie the different types of training with regard to speed, speed/strength endurance etc. Hence the attempt at the rear of the Chapter to fully illustrate the inter-relationship with examples of the various training methods. To avoid any confusion in respect of terminology Repetition Method has been re-named Intermittent Method and the three methods of

training have been reflected against a continuum of anaerobic to aerobic training. An explanation of the diagram follows.

Figure 11 A Summary of Endurance Training Methods (Harre 1973 - quoted from Dick 1980 pp 203).



4.5.1 Duration Method.

There are two types of training methods under this heading. They

are (a) the Continuous Method and (b) the Mixed Pace Method.

4.5.1.1 The Continuous Method.

This method satisfies the requirements of the medium and long term duration methods located under Aerobic Intervals.

Medium term intervals last roughly from 8-30mins with distances from 3000m-10,000m stimulating those three vital aerobic qualities namely (a) maximum oxygen uptake (b) the anaerobic threshold and (c) together with the long term duration method, the running economy. The latter method lasts under the long term category for 30+mins for distances in excess of 10,000m. Medium term endurance relies on both the lactic acid and oxygen system whilst long term endurance relies moreso on the oxygen system and, depending on the distance, fuel being available. Energy sources will be derived from the metabolism of carbohydrates and fats. Thus the link between the Duration Method and Aerobic Intervals under the Intermittent Method is inseparable.

The following are some training suggestions.

3-5 miles at a HR of 165BPM
6-8 miles at a HR of 155BPM
8-12 miles at a HR of 145BPM

Irrespective of the above steady pace running should always be done with the HR between 130-160BPM. 30mins running would be recommended for younger runners with that inclusive of longer runs between 60-120mins for the more mature athlete. The runs could be categorized into (a) the medium steady runs done at a faster pace and (b) the longer slower runs. The medium speed or steady state runs will be the most beneficial even for the longer distances. The shorter the runs the faster they should be run. The longer runs sometimes take the form of recovery runs from shorter more intense efforts.

4.5.1.2 Mixed Pace Method.

This involves slow and fast running under the Duration Method and may be referred to as Fartlek (meaning speed play). The first of

these methods is the Alternating Pace Method or a form of structured Fartlek. The runner will undertake a session of 1km with a HR at 140-150BPM with an alternating fast stretch of ½km with the HR at 170-180BPM. The session is run according to a pre-determined plan. The forced entry into anaerobic work and the repayment of the oxygen debt acts as a strong stimulus to the improvement of the VO2max.

The alternate to the above is a more natural form of Fartlek where the athlete decides, on the run, the nature of the work he will complete. It may involve fast and slow stretches of varying distances and effort over different types of terrain. This type of running will stimulate the same energy systems as the previous method under this heading.

4.5.2 Intermittent Method.

The nature of the training systems under this heading are governed by the following variables.

1. The duration of the run (distance or time; short, medium or long);
2. duration of the recovery (distance or time);
3. intensity of the training run (metres, seconds, %, VO2max, speed, maximum heart rate etc);
4. number of repetitions and sets;
5. activity during recovery (walking, jogging, passive); and
6. terrain for training (uphill, track, synthetic, sand, surf, cinder woodlands etc).

Training will be geared to the type of fitness required for the individual event. The effect in adjusting the above variables can be quite startling. The intensity of training can be alternated between (a) subcritical (running under steady state conditions) (b) critical (oxygen demands reaches oxygen supply capacity in the anaerobic threshold zone) and (c) supracritical (work performed under oxygen debt). The general nature of aerobic work is that it is of longer duration at lower intensity whilst anaerobic work is the other way around ie shorter duration of higher intensity. The intermittent method is divided into two categories (i) aerobic intervals and (ii) anaerobic repetitions.

4.5.2.1 Aerobic Intervals.

Aerobic intervals can be broken down into three categories ie short, medium and long term. Short term intervals fall under the medium duration category whilst the medium and long term intervals under the long duration.

Short term intervals last from 2-8mins (800m-3000m) which stimulates both the lactic acid and oxygen systems. Interval training in two forms can be used and they are (a) Extensive Interval work and (b) Gerschler Interval work. The extensive interval involves distances from 800m-3000m as indicated above and greatly stimulates the runners maximum oxygen uptake. Work intervals may last between 2-10mins with receveries lasting between 1-5mins. Speeds are nearer to that of race pace and this has the advantage of allowing the athlete to experience the equivalent rate of energy expenditure and muscle fibre recruitment. It also has the effect of moving large volumes of blood around the circulatory system and of opening up new capillaries. The range of pulse, depending of the individual athlete and other training variables, be in the range of 160-165BPM (or higher) at the end of the run and 140-145BPM (or slightly lower) at the end of the recovery. Examples of this type of training might involve the following.

6-8 x 1000m (30secs recovery)
4-5 x 1500m (30secs recovery)
4 x 1600m (at 5000m pace with recovery ratio at 1:1 or 1:½)
3 x 2000m (at the above pace and recovery ratio)

The Gerschler Interval work involves distances of about 200m-400m with a large number of repetitions with short recoveries ranging from 30secs to 2mins. It was thought that the stimulus was provided during the recovery when the heart filled with blood again. The pulse might be in the range of 170-180BPM at the end of the run and 120-130BPM at the end of the recovery. It more closely equated to race speed and helped the athlete develop pace judgement. Distances such as 100m, 200m, 300m and 400m can be used and in some instances 600m and 800m. The following examples are provided.

800m 8-16 x 100m
6-8 x 200m

1500m	8-10 x 400m
5000m	24-48 x 200m
	12-16 x 400m
10,000m	24-48 x 200m
	24-48 x 400m
Marathon	20 x 400m

4.5.2.2 Anaerobic Repetitions.

Anaerobic repetitions fall under the category of short duration and can be sub-divided into short, medium and long term. Short term is mainly alactic involving work up to 25secs (distances up to 200m). It falls into the category of speed work which can be further divided into speed work (up to 60m) and speed endurance (distances from 60m-150m). Adequate recovery must be allowed between intervals to enable the runner to sustain the quality of the session.

Medium term repetitions involve work between 25-60secs (distances between 200m-400m which is mainly lactic. In essence the work is short duration and short recovery. The short duration component might even include intervals as short as 100m.

Long term repetitions involve work within the range of 60secs-2mins (400m-800m) and stimulates both the lactic acid and oxygen energy systems. The work is ostensibly of long duration and long recovery and might include intervals as long as 1000m. Recoveries might be as long as 10+mins to allow sufficient rest.

This type of endurance is required to resist fatigue at loads equating to sub-maximal and maximal intensity ie between 85-100% of maximum intensity. It predominantly involves the anaerobic production of energy and it is essential that speed is not reduced due to fatigue. The athlete develops the ability to produce a high quality performance despite an oxygen debt. There are an infinite variety of training units for this purpose.

1500m runner with a PB of 3:40

8 x 400m in 57/58secs with a recovery jog of 300m in 3mins. The HR will be in the region of 180BPM at the end of the run and 120BPM at the end of the recovery.

Using a variety of distances ie

1 x 600m 3 x 400m 5 x 300m

According to Wilson (1973) the 5000m/10,000m (and Marathon) runners should progress by increasing the number of intervals and reducing the recovery time whilst the 800m/1500m runners should progress by improving the speed of the fast runs. The following table will illustrate the nature of this type of training. Heart rates of 175-185BPM can be expected after the fast efforts and 110-120BPM after the recovery.

Distance	800m	1500m	5000m/10,000m
200	6-8	8-12	
300	4-6	5-12	15-24
400	3-5	6-12	16-24
500		4-6	
600		3-5	8-12
800			8-12

The more intensive work might include 5 x (3 x 200m) with 30secs between the repetitions and 4-5mins between the sets.

Repetition running, as indicated in the long term work, will be faster, less in number and the repetitions will have longer recoveries. The following examples are provided by Wilson (1973).

800m	2-4 x 600m or 2-3 x 1000m
1500m	3-6 x 800m or 4-6 x 1000m or 2-3 x 1200m
5000m	As for 1500m or 2-3 x 2000m
10,000m	6-8 x 1000m or 4-6 x 1200m or 3-4 x 2000m or 2-3 x 3000m

800m (PB 2:00.00)	3 x 600m (85/86secs with 4-5mins recovery)
5000m (PB 13:30.00)	6 x 1000m (2:42 with 4mins recovery)

In contrast varying pace can be used in separate sets ie step-downs

3 x 300m (48secs with 100m jog recovery in 60secs)
3 x 300m (45secs with the above recovery)
3 x 300m (42secs with the above recovery)

Alternatively varying distances may be incorporated with varying pace within a unit ie the following comprises one set of a 3-set unit, with a 100m jog between sets and repetitions as follows.

600m in 108secs
400m in 68secs
300m in 48secs
200m in 30secs
100m in 14secs

This type of training helps the runner cope with the psychological demands of pace change.

4.5.2.3 Strength Endurance.

When the level of speed diminishes in a session designed for speed endurance the runner might be said to be entering the area of strength endurance. It's positioning on the illustration at the rear of this Chapter should be noted. This type of endurance is required to continuously express relatively high strength efficiency when the anaerobic by-products are accumulating. This training is not only related to alkali-acid imbalances in the working muscle but to the psychological aspects of will-power and the ability to tolerate pain. The quality demands of the work are reduced and replaced by the completion of the training unit as hard as possible. It can result in considerable wear and tear and a loss in physical and mental resilience. It does however teach the athlete to keep going when the lactate levels are high. The following training methods can be used.

Circuit training
2 x 4 x 100m 'back to back' (30secs recovery)
2 x 5 x 80m 'turnabout' (shuttle runs)
6 x 150m hill runs (90secs recovery)
5 x 80m sand dune climbs/runs (walk down recovery)
6 x 200m in surf (passive 3min recovery)
4 x 200m (high knee and clawing action with passive 3min recovery)

The variations in circuit training, hill running etc are vast and can be adapted to the runners particular needs. In addition a number of the running drills used for the improvement of the

technical aspects of the running action can be used as a form of conditioning ie high knees, kick-ups etc.

4.5.3 Competition and Testing Method.

The competition and testing methods are the best stimulus to developing specific endurance qualities. Training methods might include (a) time trials (b) specific task runs ie running 600m with the 400m point reached in a pre-determined time and then having to sprint to the finish and (c) competitions ie indoors, cross-country, road runs etc. The two components will be distance and speed in relation to race distance and race speed. The distance may be shorter, the same or longer than race distance or any of these variables but involving a variety of tasks. The speed of the run may be faster, runs with accelerations, runs with varied tasks, runs at a target speed or at maximum speed. Suggestions for time trials might include the following.

800m	600m	1000m
1500m	1000m	1200m
5000m	2000m	3000m
10,000m	3000m	6000m

4.6 Other Considerations.

It may be useful, in concluding this Chapter, to provide an overview of the various training distances for the individual events. See Table 10 (from Schmolinsky 1978 pp 161).

Race Distance	Under-Distance	Intensity	Over-Distance	Intensity
800 m	200/400/500/600/700 m	medium to high	1000/1200/1500/ 1600/2000/3000 m 8–18 km	medium to high low/medium/high
1500 m	400/500/600/800 m 1000/1200 m	low/medium/high high	2000/3000 m 8–18 km	medium/high low/medium/high
5000 m	1000/1500/1600/2000/ 3000 m	medium till high	8–10–12–15–16–18–20 km	low/medium/high
10000 m	1000/1500/1600/2000/ 3000/5000/7500 m	medium till high	10–12–15–16–18–20–25–30–km	low/medium/high
Marathon	1000/2000/3000/5000/ 7500/10000 m	medium till high	50–60 km Continuous runs: 10–15–16–18–20–25–30 km	low/medium low/medium/high

In placing the various training terminology, sections and sessions into 'compartments' the reader must exercise flexibility and appreciate the inter-relationship and dependence of one system to another.

The illustration overleaf provides a perspective for strength, cadence and stride length in relation to maximum speed and also where tactical drills and model training fall into the overall programme of endurance training methods. It is not the intention of this dissertation to deal with such areas as running drills, mobility, technique, plyometrics, exercises, weight training, circuit training and resistance runs.

4.7 An Overview of Endurance Training Methods.

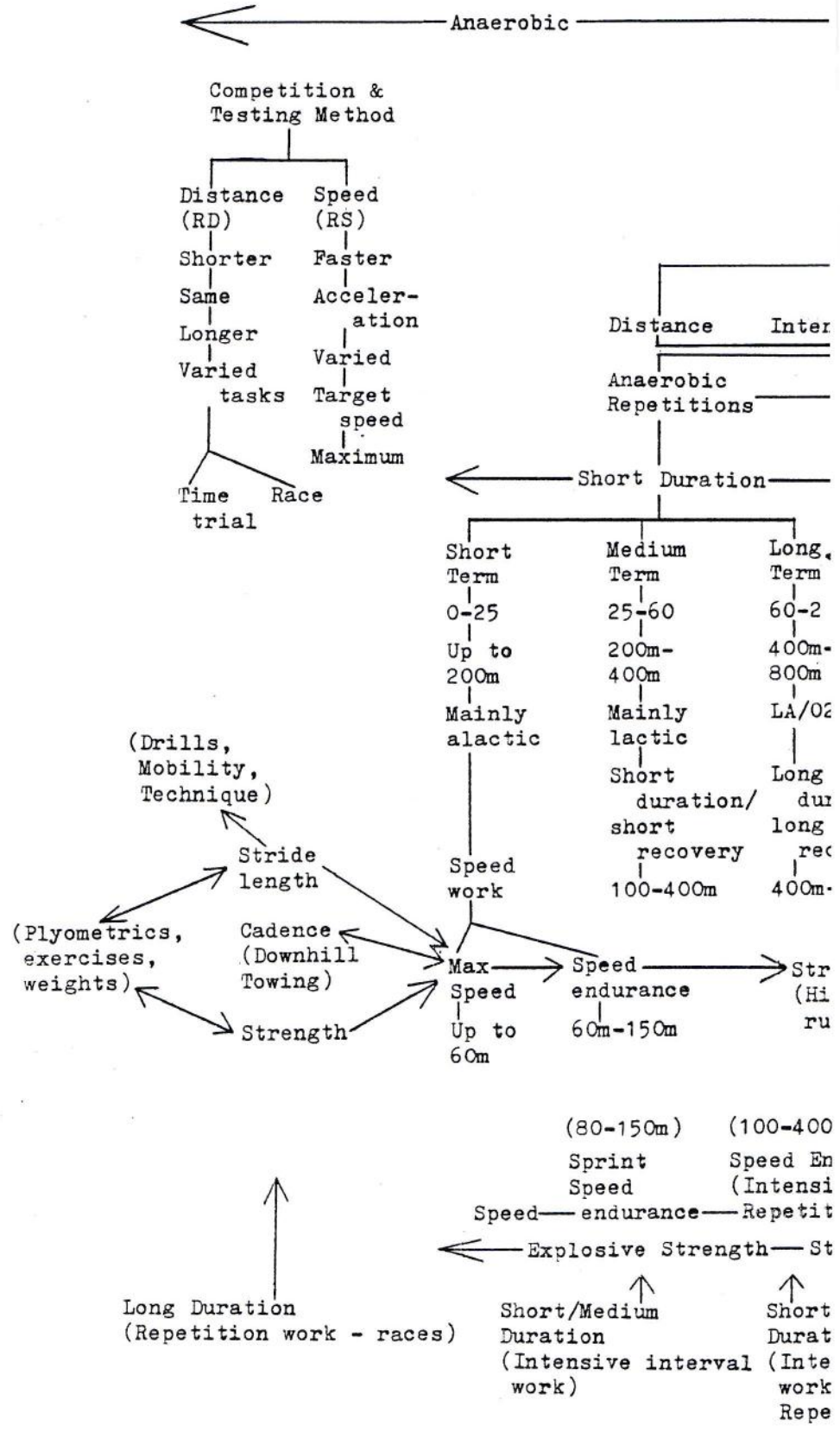
The contents of this particular Chapter have been based on an explanation of Figure 12 overleaf. This is turn has been adapted from Harre (see Page 38), Dick (from Sports Training Principles 1980), Brook (Endurance Running 1987) and Schmolinsky (Track and Field 1978).

In turn Figure 13 also overleaf is a summary of the East German's interpretation of the endurance training methods (from Schmolinsky 1978 pp 161-174).

The Author believes that there is considerable confusion amongst many coaches when trying to relate the work of Schmolinsky (Figure 13) to much of the endurance work being published in the West. Hence the attempt has been made to place the work of Schmolinsky in its correct perspective within the overview provided in Figure 12.

Both diagrams are detailed and the reader must exercise some flexibility in their interpretation. In Figure 12 the bottom line represents Schmolinsky's seven different categories of endurance. Immediately above that they have been re-arranged to 'fall in line' with interpretations provided by Brook. The basic shape of the diagrams and categories, albeit in reverse, have been drawn from Harre (as quoted by Dick). As indicated earilier Figure 13 provides a summary of the seven categories of endurance from Schmolinsky.

Figure 12 An Overview of Endurance Training Met



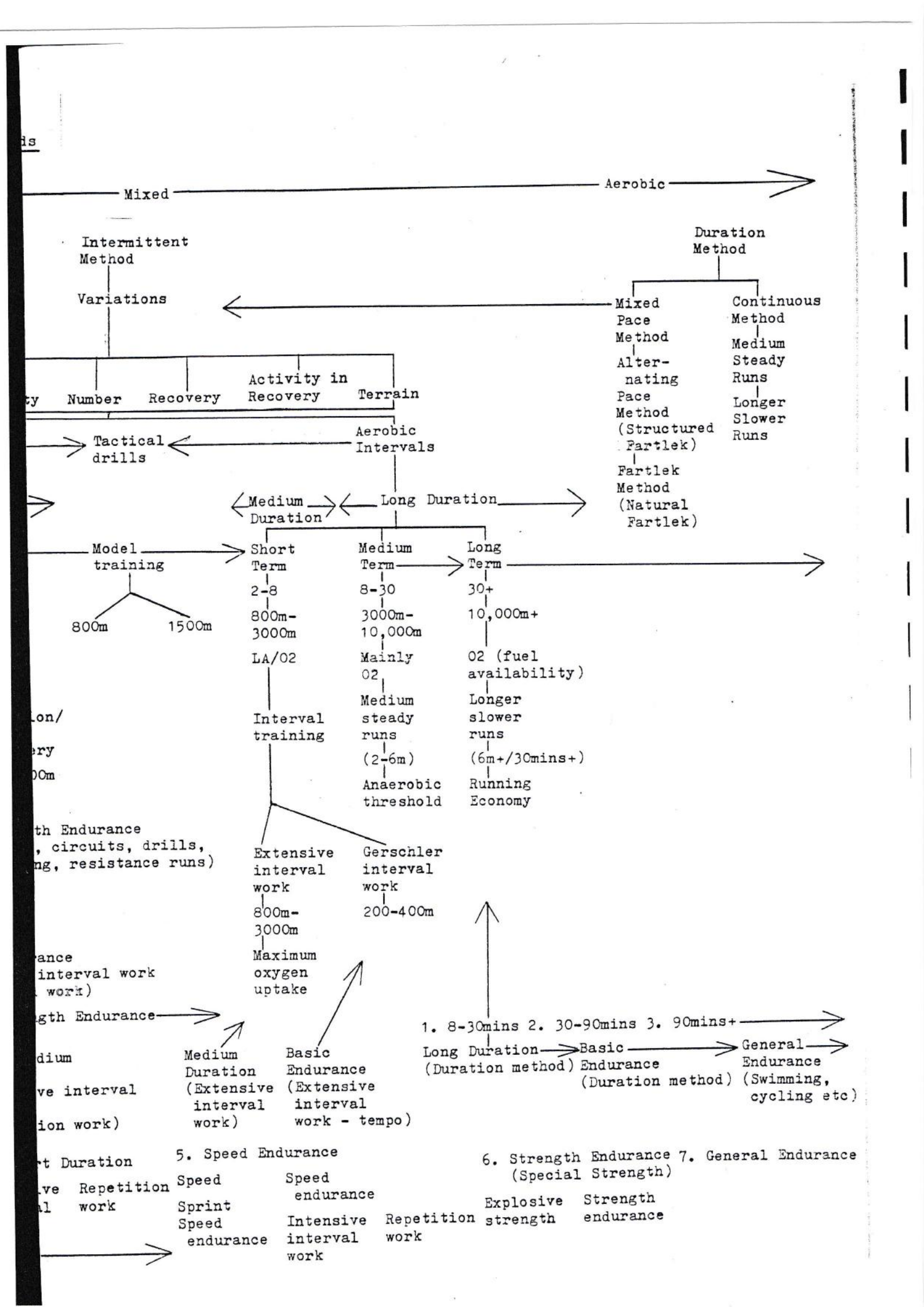

Mixed
Aerobic
Intermittent Method
Variations
Duration Method
Mixed Pace Method
Alternating Pace Method (Structured Fartlek)
Fartlek Method (Natural Fartlek)
Continuous Method
Medium Steady Runs
Longer Slower Runs
Number
Recovery
Activity in Recovery
Terrain
Tactical drills
Aerobic Intervals
Medium Duration
Long Duration
Model training
800m
1500m
Short Term
2-8
800m-3000m
LA/02
Medium Term
8-30
3000m-10,000m
Mainly 02
Medium steady runs
(2-6m)
Anaerobic threshold
Long Term
30+
10,000m+
02 (fuel availability)
Longer slower runs
(6m+/30mins+)
Running Economy
Interval training
Extensive interval work
800m-3000m
Maximum oxygen uptake
Gerschler interval work
200-400m
th Endurance
, circuits, drills,
ng, resistance runs)
ance
interval work
work)
gth Endurance
dium
ve interval
ion work)
t Duration
ve Repetition
l work
1. 8-30mins 2. 30-90mins 3. 90mins+
Long Duration (Duration method)
Basic Endurance (Duration method)
General Endurance (Swimming, cycling etc)
Medium Duration (Extensive interval work)
Basic Endurance (Extensive interval work - tempo)
5. Speed Endurance
Speed
Sprint Speed endurance
Speed endurance
Intensive interval work
Repetition work
6. Strength Endurance (Special Strength)
Explosive strength
Strength endurance
7. General Endurance

Figure 13 A Summary of Endurance Training Methods (from Schmolinsky 1978 pp 161-174).

Basic Endurance.

Duration Method
(Continuous Work)

Intensity (% of max)
- High 90-100%
- Medium 80-90%
- Low below 80%

Distances
5 10 15 20 42.2kms

Medium speed runs most beneficial even for longest distance)

Shorter the distance the faster the run

Recovery runs at slower pace - 30 60 90mins at varying speeds

* Steady state runs through varying terrain @ L M H speed

* Continuous runs starting slow, accelerating and finishing fast

* Continuous runs start and finish fast, easy pace in middle

* Continuous runs with acceleration uphill @ medium/fast effort

* Continuous runs with fixed alternation between L-M/L-H/M-H speeds over M-L distances

* Fartlek - optional and fixed distances/ speed (latter with options)

* Cross country with changing terrain at average/high speed

Extended Interval Work
(Tempo Runs)

Intensity
60-85% of max over distance (provide for some variation)

Higher speed levels than can be applied in continuous runs

Large number of reps with short recovery

Recovery
30secs-5mins with jogging over 100m/ 1000m

Fitter athletes - shorter run/shorter recovery

* Pace runs 100m-1000m in groups or alone - Devil Takes Hindmost

* Handicap runs

See Table 11

Fig 13 Sequence B

Long Duration Endurance.

Duration Method
(Continuous work)

1. 8-30mins - 3000m to 10,000m
2. 30-90mins - 10,000m to 25-30kms
3. 90-240/300mins - 25-30kms to 50kms

1. 8-30mins continuous runs over flat and hilly terrain at top speed ie cross country competition over 5/10 kms

2. 30-90mins (i) continuous runs at uniform high speed over flat and hilly terrain (8-20kms) (ii) continuous runs with strong finish (12-18kms) (iii) continuous runs with changing speeds ie 3-5 paced runs over a 10-15km run

3. Continuous runs over 90mins with even fast pace on flat course over 20-50kms

Repetition Work
(High Speed Races)

Races over 3000m 5000m 7500m 10,000m

High speed races in excess of 90% of max speed for the distance

Test or timed runs

3000m can be used in a training session

(2-8mins - 1000m/3000m) Medium Duration Endurance.

Extensive Interval Work
(Tempo Runs)

Intensity 80-85%

Recovery shorter than running time

Pulse decides length of rest - not more than 120/130BPM before start of next run

Duration within range of medium duration endurance which develops specific requirements

Overall programme has long duration character

Train alone or in groups of similiar ability/ standard

See Table 12

Fig 13 Sequence C

(50secs-2mins - 400m/800m)
Short Duration Endurance

Intensive Interval Work

Intensity 85-90%

Volume within medium duration endurance

Middle distance runners
600m 800m 1000m 1200m

Long Distance runners
1000m 2000m

See Table 13

tactical objectives - accelerations with/ without agreed signals

See Table 14

Repetition Work

Work approaching competition standard

Distance can be over or under distance

Under distance should be at race speed or faster

Over distance at reduced speed - permit 1-3 runs (completion of set task)

Long distance runners only run under distance

Intensity 90-100% of max possible speed

Middle distance runners undertake distances of $\frac{2}{5}$-$1\frac{1}{2}$ of race distance

Long distance runners undertake distances of one-tenth; one-fifth and $\frac{1}{3}$ of race distance

Recovery depends on target set - if high speed cut volume (reps) - recovery of optimal length (athlete may decide when to start next rep

Duration (length of trging distance/ intensity to lie w/i medium duration range

Quality of work will positively influence long duration capacity

* High speed runs (alone/groups of similiar standard) with or w/o set tasks

* Handicap runs

* Speed changing runs - alone/groups of similiar standards) with or w/o

Intensive Interval Work

Very important to middle distance runners

Important to reach near max speed in each rep

Intensity 90-95% of possible speed over training distance

6-8 runs adequate

400m PB 50secs - 90% equates to 55secs - at 95% (52.5secs) only 3-4 runs possible

Recovery
adapted to training objectives ie 3-5mins

Carry over to medium duration endurance

* Runs at speed

* Speed changing runs

* Differential runs (400m - target 55secs 200 @ 30; 200 @ 25)

* Handicap runs

All runs started with all out effort in first 6-10 strides

Fig 13 Sequence D

Repetition Work

Very important to middle distance runners to achieve highest possible speeds

Length of recovery of secondary importance (should be properly restored before next run)

Intensity 95-97%

Volume - distance of
400m-1000m 1-2 or
2-3 reps

3 x 400m 3 x 600m
1-2 x 800m

1-2 x 1000m (for MD)
1-3 x 1000m (for LD)

Recovery - up to the runner but not less than 10mins

Duration within short duration range, carry over value to short/ medium duration and speed endurance

* Speed runs
* Speed changes
* Differential runs
* Handicap runs

(same as intensive interval work)

* Competitions

Important to keep warm between runs

Speed and Sprint-Speed Endurance (for Middle Distance runners)

Runs over short distances ie 100m-400m using intensive interval work and repetition work may develop basic speed at the same time

* Standing/crouch/ flying starts over 20m to 100m
* Accelerations at max (middle and final sections) over 80m to 150m
* High speed runs over 100m to 200m
* Harness runs over 80m to 120m
* Towing (artificial traction) over 80m to 120m
* Downhill/uphill sprints

Speed Endurance

* Running at speed
* Runs with changes in tempo
* Differential runs
* Handicap runs
* Uphill/downhill runs

All over 100m to 400m

Strength - Strength Endurance - Explosive Strength

Special strength for runners for those muscles involved in running action ie push off in ankle joint

Running and strength exercises
knee lift runs
running jumps
ankle exercises

Using extensive interval work strength endurance will be developed ie 50-60m in series of 3-6 reps or distances in 100m to 1000m range

Using intensive interval work explosive strength will be developed ie 20-50m in series of 1-3 reps

Plyometrics
Hurdle jumps
Jumps (on the spot or slow advance)

Strength endurance
Harness resistance
Sand dunes
Snow
Running/jumping uphill (200m to 800m)
Weighted vest

General strength
Circuit training

Loosening and stretching exercises

Fig 13 Sequence E

General Endurance

Training methods are not peculiar to running

May include swimming, ski-ing, cycling, games and light-hearted exercises

Applied in wide variety of ways to build up endurance

Should not overtax youngsters

For more advanced athletes these methods need not be concerned with running

Can be used for (i) stabilizing general condition or (ii) balancing high specific stress

Table 11 Extended Interval Work (Basic Endurance)

Distance	Number of Runs	Recovery Interval	Activities during Interval
200 m	20–40	30– 90 sec.	Jogging
400 m	20–40	60– 90 sec.	Jogging
800 m	10–20	60–120 sec.	Jogging
1000 m	8–12	120–300 sec.	Jogging

Table 12 Extensive Interval Work (Medium Duration Endurance)

Distance	Number of Runs	Recovery Interval (Recovery between Series)	Activities during Interval
800 m	8–12	90–120 sec.	Jogging/Walking
	(in series 2–3×4)	(3–5 min.)	Jogging/Walking
1000 m	8–12	90–180 sec.	Jogging/Walking
	(in series 2–3×4)	(4–6 min.)	Jogging/Walking
2000 m	6–8	120–180 sec.	Walking/Jogging
	(in series 2×3–4)	(5–10 min.)	Jogging/Walking

Fig 13 Sequence F

Table 13 Intensive Interval Work (Medium Duration Endurance)

Distance	Number of Runs	Recovery Interval (Recovery between Series)	Activities during Interval
600 m	4–6	2–5 min.	Walking/Jogging
	(in series 2×2–3)	(5–10 min.)	Jogging/Walking
800 m	4–8	2–5 min.	Walking/Jogging
	(in series 2×2–4)	(5–10 min.)	Jogging/Walking
1000 m	4–10	3–5 min.	Walking/Jogging
	(in series 2×2–5)	(5–10 min.)	Jogging/Walking
1600 m	4–8	3–5 min.	Walking/Jogging
	(in series 2×2–4)	(5–10 min.)	Jogging/Walking
2000 m	3–6	4–8min.	Jogging/Walking
	(in series 2×3 or 3×2)	(5–10 min.)	Jogging/Walking

Table 14 Repetition Work (Medium Duration Endurance)

Distances	Number of Runs	Recovery Interval	Activities during Recovery Interval
Middle-distance Runners			
600 m	2–4	10–20 min.	Walking/Jogging
800 m	1–3	10–30 min.	Walking/Jogging
1000 m	1–3	10–30 min.	Walking/Jogging
1200 m	1–3	10–30 min.	Walking/Jogging
1600 m	1–3	10–30 min.	Walking/Jogging
2000 m	1–2	10–30 min.	Walking/Jogging
Long-distance Runners			
1000 m	1–3	10–20 min.	Jogging/Walking
	3–6	5–10 min.	Jogging/Walking
1200 m	1–3	10–20 min.	Jogging/Walking
	3–6	5–10 min.	Jogging/Walking
1600 m	1–3	10–20 min.	Jogging/Walking
	3–6	5–10 min.	Jogging/Walking
2000 m	1–2	10–20 min.	Jogging/Walking
	3–5	5–10 min.	Jogging/Walking
3000 m	1	–	–
	2–3	10–20 min.	Jogging/Walking

Chapter 5

The Planning of the Training Programme.

5.1 The Training Units.

5.1.1 Microcycles.

5.1.2 Macrocycles.

5.2 Periodization.

5.3 Marathon Preparation.

5.4 Long Term Planning.

Training methods are required to be placed into a programme so that maxmimum benefit can accrue. However this programme will vary from individual to individual according to their event, their strengths and weaknesses, stage of development and the time of the year. Training should adhere to certain principles to be totally effective. These involve the principles of (a) overload (b) progression (c) specificity (d) reversibility and (e) recovery.

(a) Overload - the work load has to be sufficiently demanding to allow the body to adapt and to improve its performance capacity. Accordingly training can be structured to ensure that this adaptation takes place.
(b) Progression - as a runner adapts to training so the work load must be gradually increased to avoid a plateau effect in the adaptation process. There will be a difference in emphasis between aerobic and anaerobic work depending on what stage of the training year the runner has reached. There will be an increase in the volume of aerobic mileage during the preparation phase and an increase in quality (speed) of the aerobic and anaerobic work during the special preparation phase of the training year.
(c) Specificity - training effects are specific to the individual and to the type of work undertaken. It is related to the runner's present level of fitness and to the demands of the event.
(d) Reversibility - training and performance capacities reverse once training stops. The rate at which this capacity is lost will depend on the background of the runner concerned. The rate at which it is lost may equate to the rate at which it took to gain it. For experienced runners this process will be slower.
(e) Recovery - this is the period during which the adaptation takes place. If the period is too short the recovery will be incomplete and may result in the usual symptoms of overtraining. 48-72 hours may be needed between two similiar hard anaerobic sessions. Aerobic sessions are not usually as demanding.

5.1 The Training Units.

A single training unit is one practice session in pursuit of a training objective. Several units may be placed together into one practice session ie mobility unit, speed endurance unit followed by an aerobic unit. Similiarly two and in some instances three

practice or training sessions may be undertaken in one day. Training units are organised into microcycles and macrocycles to form the overall framework of the annual periodized year.

5.1.1 Microcycles.

The microcycle is a group of training units organised so that optimal training value can be obtained from each unit. They can be planned for a period of one week and the extent and intensity of loading during the course of this cycle is referred to as the 'structure of loading'. It is unwise to expose the runner to high demands on his system in successive units and the coach is advised to closely monitor the effect of certain types of units upon his athlete.

Units should be structured with a specific objective in mind and should vary from day to day bearing in mind the different fitness characteristics of the athletes particular event. To avoid over-exertion intervals should be introduced between training units to assist in the recovery process. This can be aided by active recovery ie longer slower runs, fartlek etc. Care needs to be also taken when training units with different objectives and demands follow each other. In some instances complete recovery may be called for. Irrespective the units allow for specific objectives to be concentrated on and for the desired stimulus to be achieved. This will have a particular effect on the adaptation process. Planning the microcycle in such a way will help avoid monotony and ultimate stagnation.

High demands in particular training sessions ie strength/speed endurance, time trials etc should never be followed by a further day of high demands. This same principle applies when several units are performed in one day. The following illustrates the correct sequencing of training units (from Dick 1980 pp 242).

Several units in one day.

a. Warm-up and/or mobility;
b. neuromuscular work (ie technique, speed, maximum strength, elastic strength);
c. energy systems work (all endurance ie heart, speed, strength);

d. aerobic warm-down.

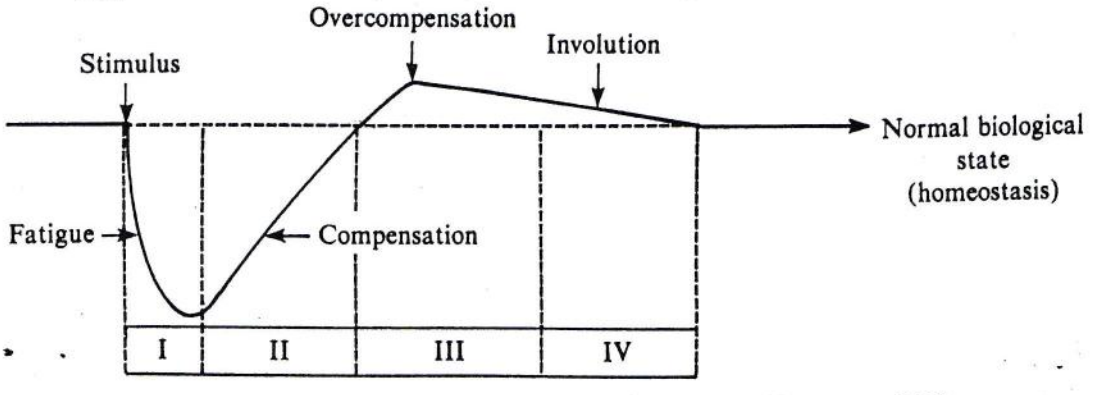
From day to day.
a. Aerobic/general/recovery;
b. neuromuscular;
c. anaerobic endurance.

Normally 24 hours is required to recover from high loadings, which includes competitive efforts, or as indicated earilier in the introduction to this Chapter. Overcompensations refers mostly to the effects of work and regeneration. All individuals have specific levels of biological function during normal daily activity. When exposed to a series of stimuli supplementary food stuffs are burnt off disturbing the normal biological state. The organism and the central nervous system fatigue with high lactic acid concentrations in the blood and at cell level. Fatigue at the end of the training session reduces the organism's functional capacity.

Following training there is a period of recovery during which the biochemical sources of energy are not only replaced but may overpass the initial level by acquiring some reserves causing the organism to rebound or to be in a state of overcompensation. This leads to increased running efficiency resulting from this adaptation.

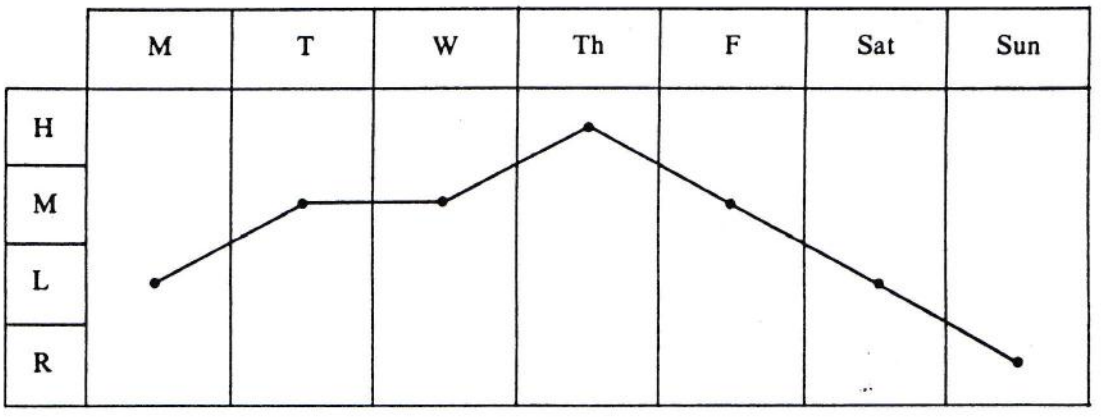
If another stimulus is not applied at the optimal time, during the overcompensation phase, then involution occurs and the over-compensation fades away returning to the normal biological state.

Figure 14 The Overcompensation Cycle (modified from Yakovlev 1967 and quoted from Bompa 1983 pp 74).

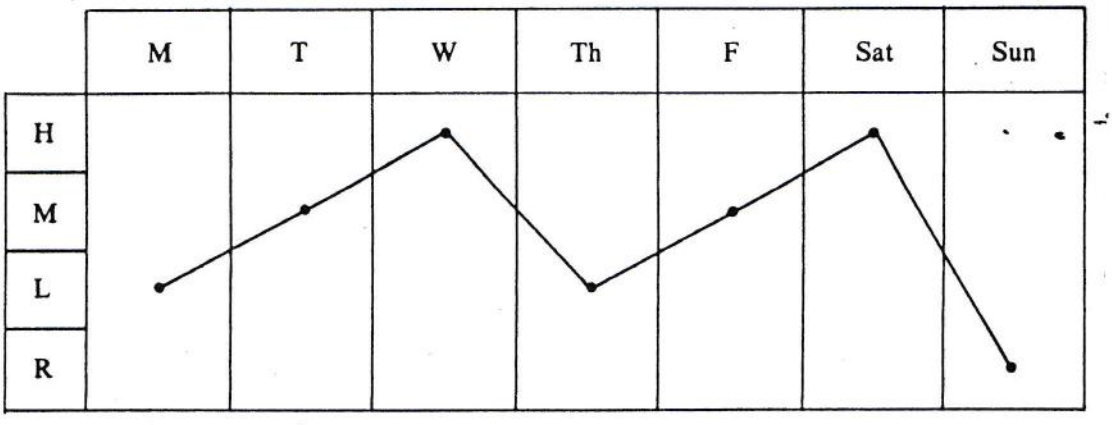


The following six figures illustrate the various structures of microcycles involving one, two and three peaks. Other combinations can be made by the coach depending on the needs of the athlete bearing in mind his training and competitive requirements.

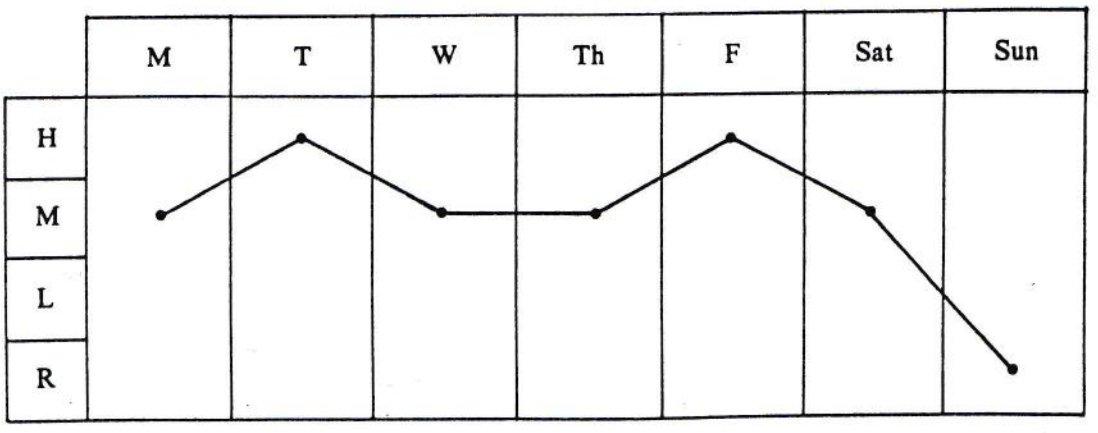
Figures 15, 16 and 17 (from Bompa 1983 pp 117-118).



A micro-cycle with one peak.

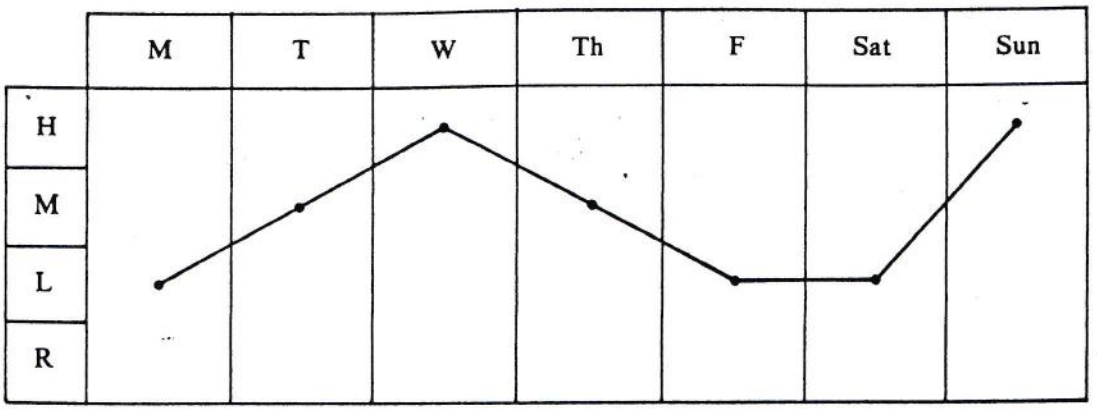


A two-peak micro-cycle.

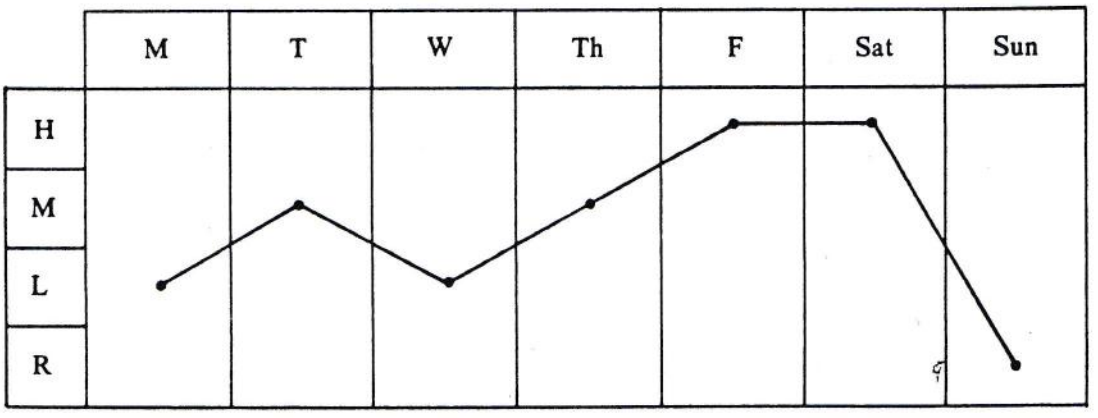


A two-peak micro-cycle but of higher demand.

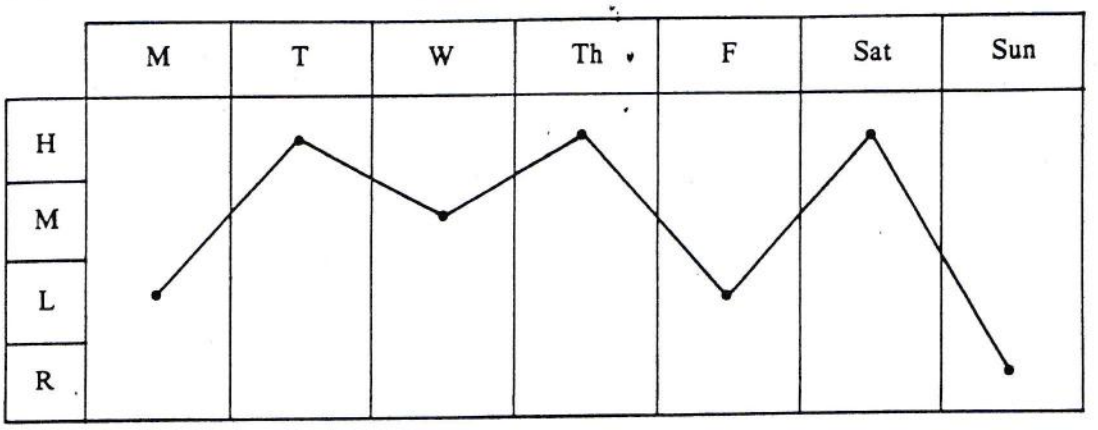
Figures 18, 19 and 20 (from Bompa 1983 pp 118-119).



A two-peak micro-cycle, where the second one is a competition, preceded by two unloading training lessons.



Two adjacent peaks of a model training micro-cycle.



A three-peak micro-cycle alternated with lower intensity training lessons.

5.1.2 Macrocycles.

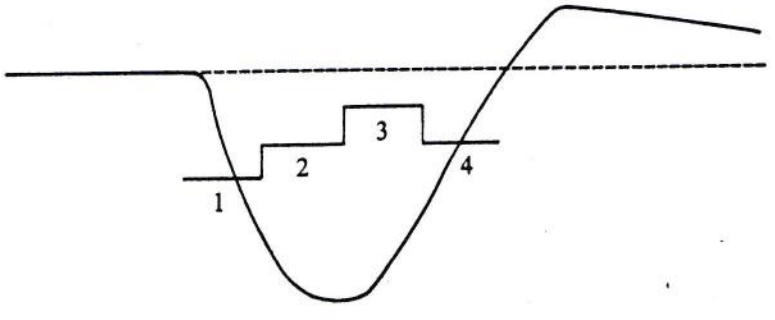
The coach will require the following information in preparing

the structure of macrocycles (a) the number of training units available (b) the % distribution of general/specific/competition specific training (c) the training ratio (d) the structure of loading and the intra-unit ratios pertinent to each type of training and (e) the manner of increasing extent and intensity within the macrocycle.

The length of the macrocycles may vary during the different phases of the training year according to (a) the progress of intensity and (b) the extent of loading. It may change from high average loadings to shorter periods of reduced loadings. They will be closely regulated during the competitive phase when they may extend in duration from 2-4 weeks up to 4-6 weeks during the preparatory phase. During the preparatory phase the principle is followed of first increasing the overall load and thereafter by an increase in the intensity. Most runners complete 3 weeks of hard training followed by a fourth easy or recovery week before advancing to the next 4-week cycle.

The overcompensation concept may be applicable to the macrocycle and even to longer phases of training.

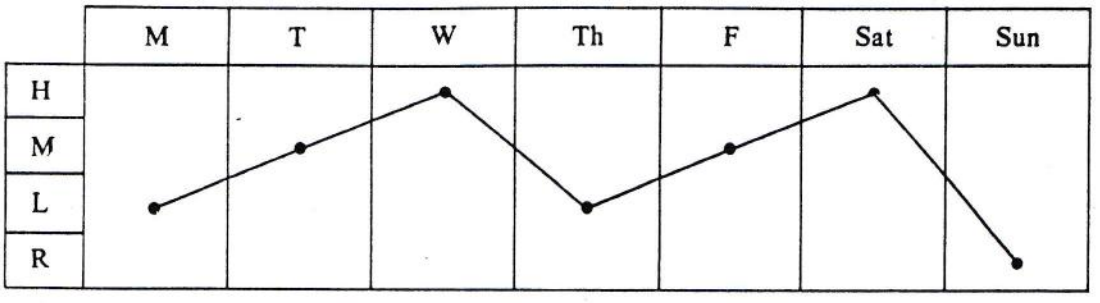
Figure 21 The Overcompensation Cycle of a Macrocycle (from Bompa 1983 pp 74).



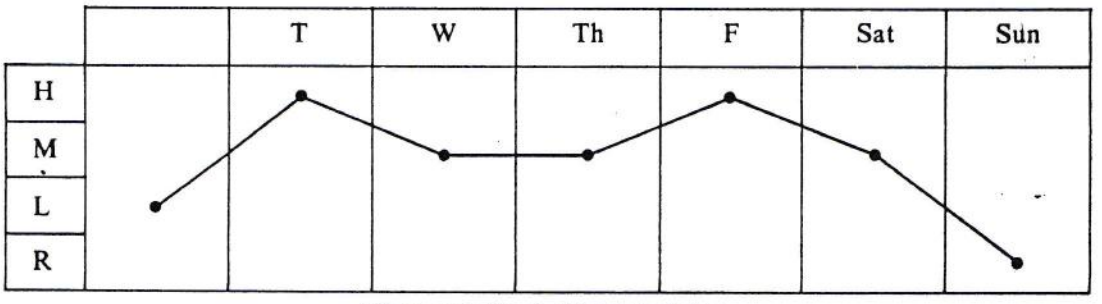
During the first three microcycles the athletes fatigue. When the load is slightly decreased in the fourth microcycle the organism begins to compensate and rebounds into a phase of overcompensation. What has to be borne in mind here is that many elite athletes follow training programmes that do not allow for 24 hours between training sessions. They are exposed to a second set of stimuli before the involution completely eliminates the benefits of the

overcompensation phase. The rate of improvement is higher when athletes are exposed to more frequent training stimuli, providing of course, that the frequency is not so great as to preclude the overcompensation phase altogether. This will inevitably lead to a decline in performance.

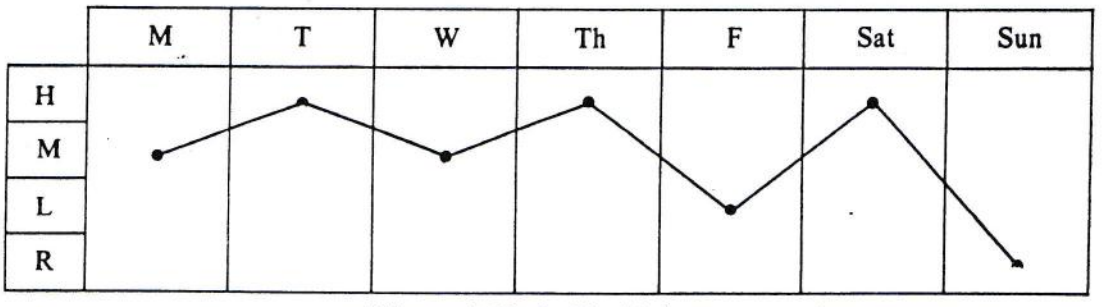
What follows is a diagram showing the classical structure of a macrocycle where the first three microcycles are developmental and the fourth one is a recovery cycle. See Figure 22 below (from Bompa 1983 pp 178).



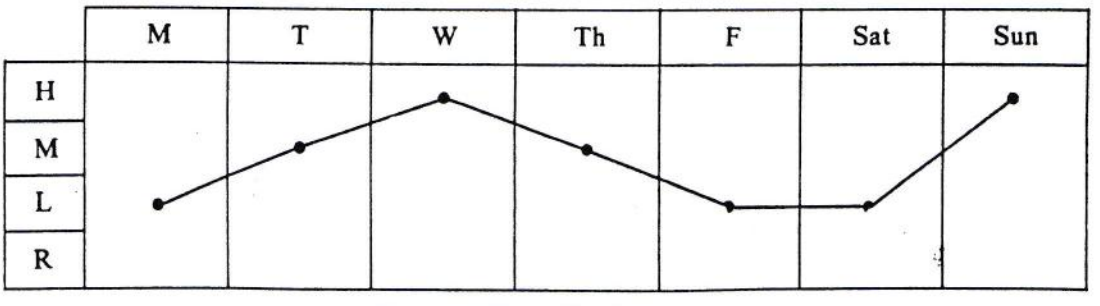
Micro-cycle No. 1. The first step of load increment.



Micro-cycle No. 2. The second step.

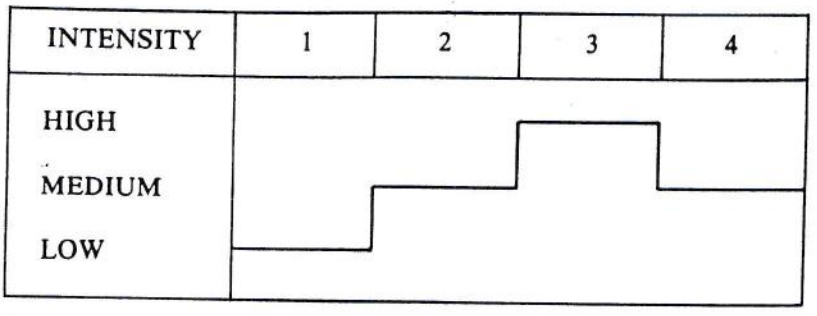


Micro-cycle No. 3. The third step.

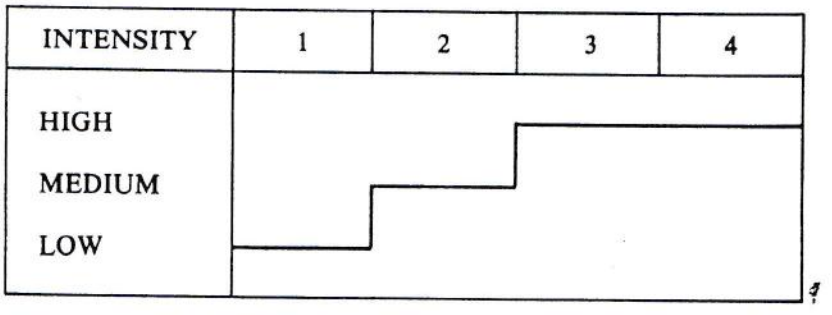


Micro-cycle No. 4. The fourth step.

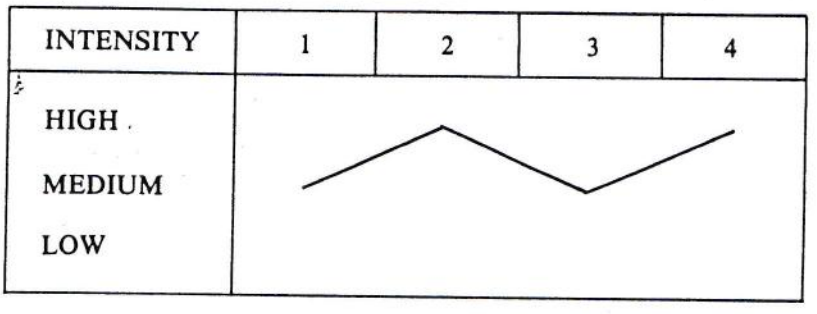
Similiarly the following are a few suggested variations of the macrocycle construction which the coach may utilise in drawing up endurance training schedules. See Figures 23, 24, 25 and 26 (from Bompa 1983 pp 130-131) hereunder.



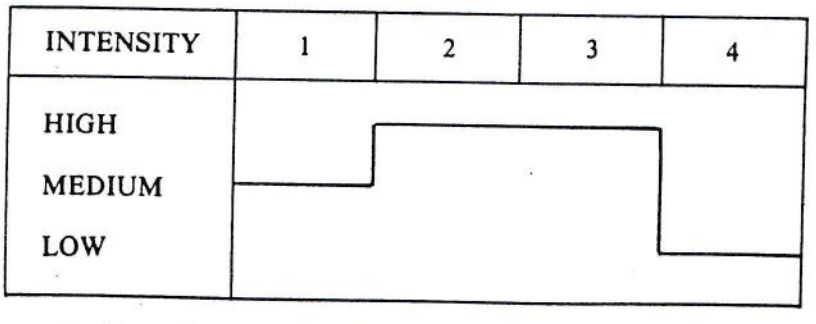
The step-type approach: three developmental micro-cycles followed by a tuning (unloading) one.



A structure of a macro-cycle useable in the loading portion of the preparatory phase.



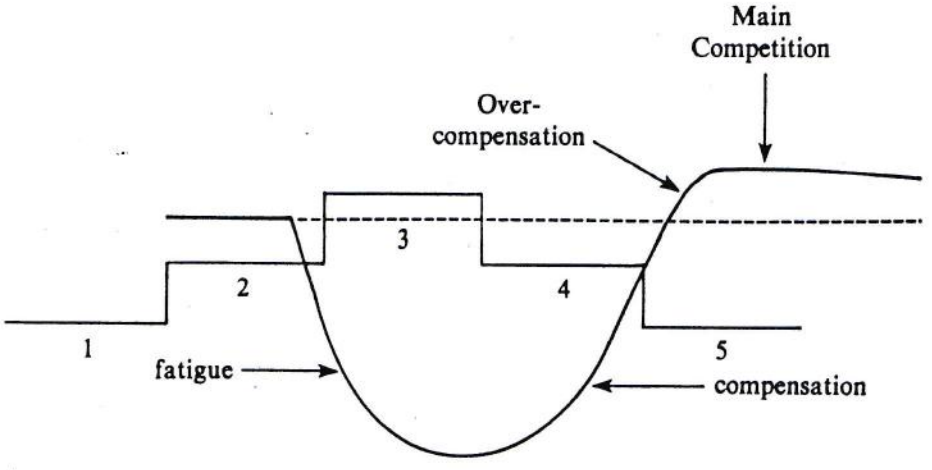
A two peaks or wave-like structure. Following a regeneration cycle, the fourth one reaches the highest intensity.



Another variation with two peaks followed by a regeneration micro-cycle, at the end of which a competition may be planned.

It is vital that the runner arrive at major and important competitions in the best possible physical and mental condition. The correct unloading phase prior to competition represents one of the most important and crucial aspects of peaking. The following diagram illustrates the structure of the last five microcycles prior to a major competition. During the first three weeks the load in training is still progressively and carefully increased whilst during the last two weeks the coach unloads the training programme to facilitate overcompensation.

Figure 27 A Correct Unloading Prior to the Main Competition Facilitates Overcompensation (from Bompa 1983 pp 76).



The plan within which is encompassed the various cycles of training would appear to fall into two categories (i) the Lydiard Method or (ii) the Complex Method. The former has many forms and variations and each coach, including his athletes, will have their own interpretations.

Figure 28 Interpretation of the Lydiard Method of Planning Endurance Training (from Sinkkonen 1975 and quoted from Dick 1980 pp 211).

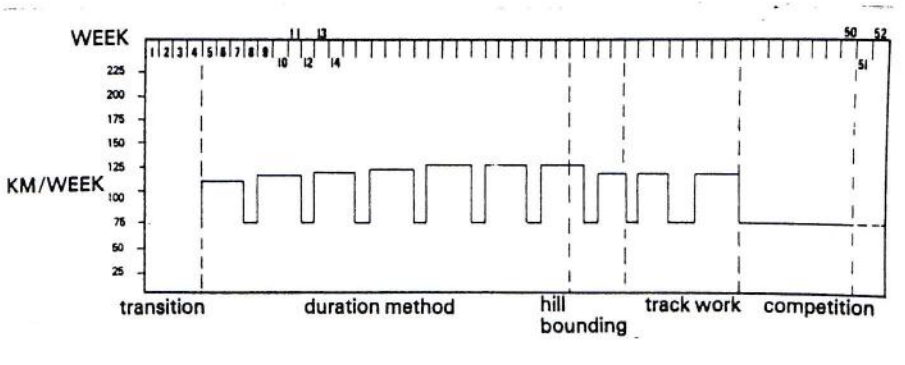
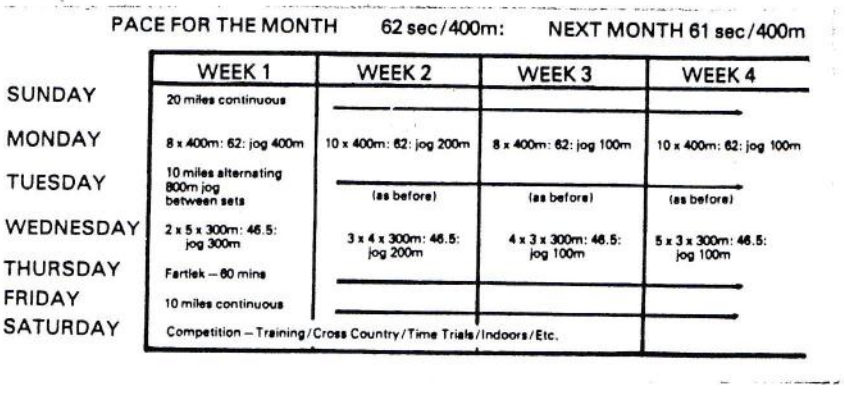


Figure 29 Interpretation of the Complex Method of Planning Endurance Training (from Dick 1980 pp 212).



It is important that within the macrocycles careful emphasis is placed on the distribution of general, special and competition specific training and that the different phases are structured so as to meet the objectives relative to that period within the annual cycle. This can be done by (a) establishing the number of units per microcycle (b) the objectives sought within these units (c) the objective within the microcycle (d) the objective within the macrocycle (e) the detail of each training unit in respect of distances, times, repetitions, sets, exercises etc and finally (f) the progression of extent and intensity would need to be establish

As a guide to training ratios the table hereunder offers suggested percentages on which to work for the track events.

Table 15 % Distribution of General (G), Special (S) and Competitio Specific (C) Training Units According to the Phase of the Periodis Year (modified from Osolin and Markov 1972 and quoted from Dick 1980 pp 245).

	Percentage of training units																	
beginners and	*I*			*II*			*III*			*IV*			*V*			*VI*		
developing athletes	*G*	*S*	*C*	*G*	*S*	*C*	*G*	*S*	*C*	*G*	*S*	*C*	*G*	*S*	*C*	*G*	*S*	*C*
10–14 yrs	70	10	20	60	20	20	50	20	30	60	20	20	50	20	30	80	10	10
15–17 yrs	60	20	20	50	25	25	50	20	30	50	25	25	50	20	30	70	20	10
18–19 yrs	50	25	25	40	25	35	25	25	50	45	30	25	15	25	60	75	15	10
novice seniors	50	25	25	40	25	35	25	25	50	45	30	25	25	25	50	75	15	10
experienced athletes																		
sprints, long and triple	25	55	20	15	60	25	10	55	35	25	55	20	10	60	30	80	10	10
middle distance and walkers	20	75	5	20	70	10	10	70	20	10	85	5	10	80	10	55	40	5
long distance and marathon	10	85	5	10	85	5	5	90	5	10	85	5	5	90	5	45	50	5

5.2 Periodization.

Training objectives are important as they provide the runner with incentives. The runner should have two sets of objectives (i) a short range objective for that particular season and (ii) a long range objective for a period of 2-4 years which may fall within the Olympic cycle or the ever increasing number of major championships in between ie World Championships, Commonwealth and/or African Games etc. The division in training to meet these objectives and to peak during the competition period is called periodization.

When there is one competition period over the full year this is called single periodization and may involve the runner who does not specifically prepare for the indoor or cross-country period. Figure 30 is such an example (from Brook 1987 pp 42).

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Phase	General				Special			Competition				Tran
Period	Preparation							Competition				Tran

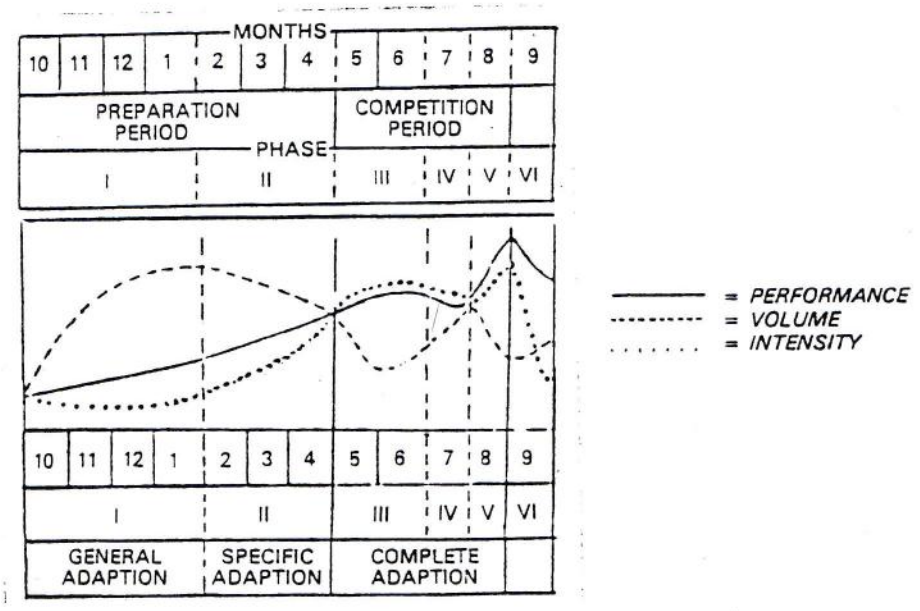
If there are two competitive periods, winter and summer, involving specific preparation for indoor and cross-country championships over the 12-month period this is called double periodization. Figure 31 is a further example (from Brook 1987 pp 43).

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Phase	General		Spec	Indoors		General		Spec	Track Comp			Tran
Period	Preparation			Comp		Preparation			Comp			Tran

Training programmes must be constructed on a yearly basis with clear cut evaluation, as far as is possible, of the four areas of preparation namely (i) physical (ii) tactical (iii) technical and (iv) psychological. Once this has been done the training year can be broken down into different periods which are (i) preparation (ii) competition and (iii) transition.

These three periods are further divided into six phases. Since training follows a cyclic pattern the phases are divided into macrocycles of 2-6 weeks duration which are then divided into microcycles of 7-14 days duration. As explained in the previous chapter identification of the training objectives must be matched by the knowledge of how to adjust and meet individual needs. The whole process of periodization is concerned solely with peaking and providing optimal performance on a given day. The following diagrams are a more complex view of the single and double periodized year.

Figure 32 Single Periodization and Figure 33 Double Periodization (adapted from Matveyev and quoted from Dick 1980 pp 229-234).



Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
PREPARATION				COMP	T	PREPARATION			COMPETITION		T
I		II		III		I	II		III	IV V	VI

The following is a detailed look at the basic principles of the various components of the periodized year.

Phase 1 - General Event Adaptation.

(4-8 weeks)

Objectives.

- To develop all round fitness using sub-maximal training.

- To identify, evaluate and test individual strengths and weaknesses to design an injury preventive programme.

This phase is like putting money in the bank in the form of reserves to build a base by using many different variables. A number of different strength and suppleness exercises along with high volumes of low to medium (60-70%) intensity running, from sub-maximal speed to extensive and continuous tempo, gives an athlete the necessary preparation base to enter the next phase. It is critical to complete this phase and not to hurry it. Specificity and peaking cannot occur without first establishing the body's total general adaption.

Phase 2 - Specific Adaption.

(4-8 weeks)

Objective.

- To increase progressively first the volume and then the intensity to unite event-specific training with competition.

This is the hardest preparation phase, demanding a gradual increase in volume followed by intensity. It may take 4-5 weeks to increase intensity by 10%, so movement here is slow. Each specific load must match the athlete's capabilities to allow the body to adapt. If the athlete is unable to work out the next day after a session, then the load was too hard and injury may result.

Phase 3 - Complete Adaption (Competition).

(3-4 weeks)

Objectives.

- To develop and maintain competitive performance leading to peaking by an increase in intensity and a decrease in volume.
- To establish the correct number of competitions for peaking in order to peak.

This phase of competition may be repeated both indoors and outdoors with specific objectives desired for each. Indoors may be used to evaluate and stabilize the present level of fitness gained, to establish the correct number of competitions necessary to peak and to achieve indoor personal bests by an expansion of the competitive experiences. Outdoors this phase may be used to qualify for international teams in which a peak performance is necessary, to rehearse race patterns or rhythm and to establish a pattern for summer. Phase 3 represents the sum of all the work done up to this

point. It is short and may consist of 10-day microcycles to allow the body to recover and to allow maximum peaking in later phases.

Phase 4 - Break.
(3-4 weeks)
Objectives.
To avoid high level competition in order to provide psychological and physiological recovery, thus reducing the possibility of injury.
- To make final adjustments to individual fitness requirements, race plans and peaking procedures.
Peaking cannot be maintained for very long since it exhausts and strains the body. This phase introduces less intense work whilst stabilizing the major components for the final assault on the principle competition of the year, such as the Olympic Games or an international meeting.

Phase 5 - Specific Competition.
(3-4 weeks)
Objective.
- To provide the optimal performance of the year.
This phase demands optimal intensity and rest. Rest is the single limiting factor to complete the adaption capacity.

Phase 6 - Transition or Recovery.
(3-5 weeks)
Objectives.
- To recover psychologically and physiologically.
- To recover by using an active approach while preventing major detraining effects.

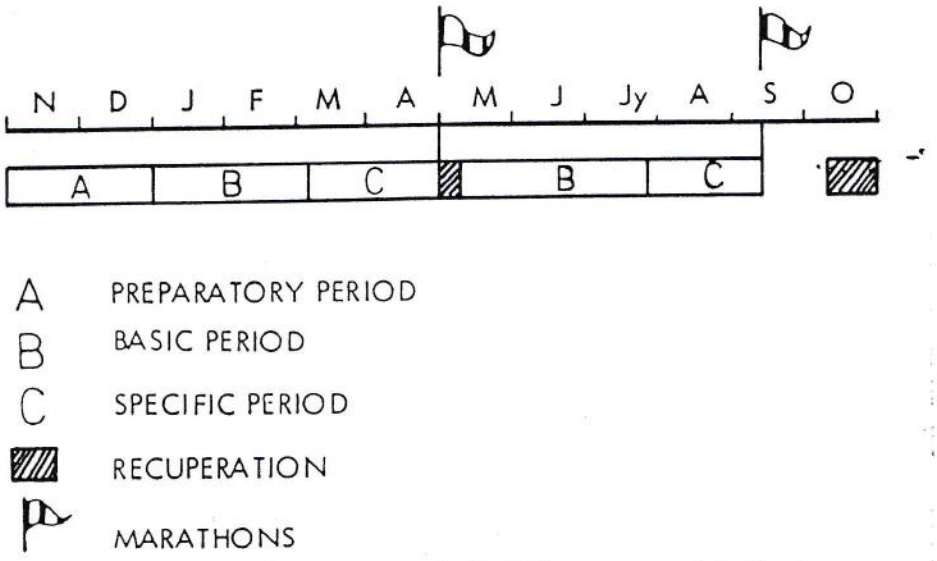
5.3 Marathon Preparation.

This section deals with experienced marathoners who have at least 2 years experience in the event and is drawn from the ideas of G. Lenzi in a paper presented at the ELLV Coaching Seminar in Portugal (1983). The information is quoted from Alford 1983 pp 59-66.

A maximum of 2 marathons a year are advocated to allow the athlete to recover mentally and physically from training and racing.

However it may still be possible within a short period, using the already high level of fitness achieved, to compete in a second marathon almost immediately after the first ie within 2-3 weeks. However this will depend on many factors related to recovery. Irrespective this procedure should be the exception as opposed to the rule.

The periodizing of the marathon year allowing for two competitions is illustrated hereunder. Figure 34 Periodization for the Marathon (from Lenzi 1983 and quoted from Alford 1983 pp 63).



Preparation should be based on some other means of preparation othe than running alone thus providing a balance for general muscular efficiency. 5-6 months is required to prepare and there is no difference between men and women besides the degree of intensity related to performance capabilities. The above Figure 34 provides a breakdown of the relevant preparation work in the different periods with differing objectives. The programme may be adjusted to suit individual fixture lists assuming, of course, that the same principles are followed.

Figure 35 Preparation Period A (Lenzi 1983 and quoted from Alford 1983 pp 64).

The aims and methods contained in Figure 35 are reflected overleaf on Page 65.

Figure 35

AIMS	METHODS
1. Muscular Efficiency	- General Exercises - Circuit Training - Hill Runs
2. Mobility	- Stretching - Active Suppling Exercises
3. Aerobic Endurance	- Slow and Medium Pace Runs

This provides a return to the conditioning of the general musculature of the athlete ie feet, legs, pelvic girdle etc. Flexibility exercises are used to stretch the muscles, minimise imbalances etc and are of the more dynamic type as opposed to the more traditional exercises currently in use. Aerobic runs are of an easy pace for brief durations (up to 90-100mins during 2 daily sessions at the end of the period).

Figure 36 Basic Period B (from Lenzi 1983 and quoted from Alford 1983 pp 64).

AIMS	METHODS
1. Anaerobic Endurance	- Hill Runs - Repetition Trails - Cross Country, Track } Races
2. Aerobic Power	- Fast Runs - Continuous - Broken
3. Aerobic Endurance	- Slow and Medium Pace Runs
4. Muscular Efficiency	- General Exercises - Hill Runs
5. Mobility	- Stretching - Active Suppling
6. Technique	- Internal Runs (100-400m)

This is a fundamental stage of training involving both quantity and variety and is a basis for more general endurance ie uphill runs, repeated lactic acid tests, road races and cross country competitions (perhaps a few track races depending on the season). Cross country is regarded as very important involving,

as it does, softer running surfaces and inducing better control of the feet together with a strengthening of the ankles. The training also involves different types of runs with varying intensity with sessions on the road from time to time. The long run will be of 2 hours. Exercises and suppleness will be retained as will work on running technique, co-ordination, relaxation and economy of movement. The latter will involve a form of interval training using distances between 100m-400m at the end of low/ medium pace runs.

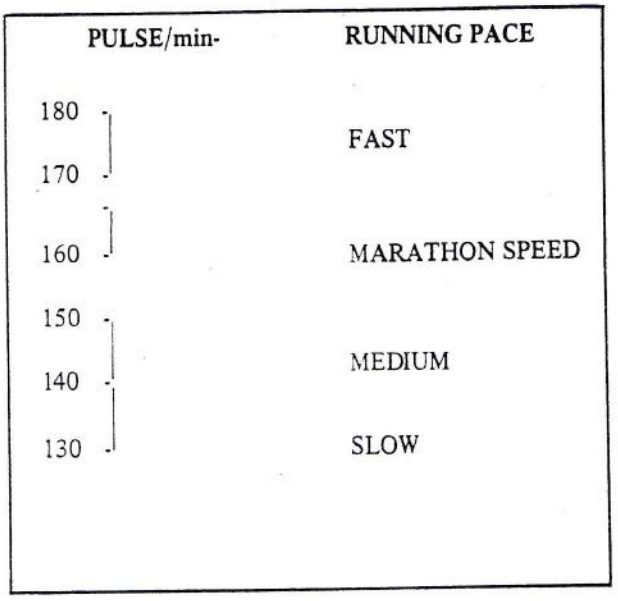
Figure 37 Specific Period C (from Lenzi 1983 and quoted from Alford 1983 pp 64).

AIMS	METHODS
1. Aerobic Endurance	- Long Runs (120-180m (120-180 min) - Slow and Medium Pace Runs - Marathon Pace Runs
2. Aerobic	- Fast Runs Continuous Broken - Road Races
3. Technique	- Interval Runs (100-200m)
4. Mobility	- Stretching
5. Muscular Efficiency	- Hill Runs

In this period aerobic running takes precedence over all other forms of training as the marathon is 97-98% aerobic. The volume of work will increase considerably and may exceed 200kms per week in the 3rd and 4th week before the marathon competition. The problem lies in assessing the different degrees of intensity of work and how this should be alternated in time to push the system to high and stable levels to achieve the best speed for the race. There is also the question of muscle and liver glycogen stores. This can be minimised by training to increase the efficiency of fat metabolism through medium and long duration runs. These runs also help in (a) sustaining prolonged work and (b) adapting psychologically to the prolonged effort. Fast pace and road races

are also important in an effort to stimulate (a) an increase in the VO2max and (b) the anaerobic threshold allowing for greater speed to be achieved. Aerobic power and endurance will be achieved through marathon pace runs. This will involve an ideal competitive pace using an economical running action and allowing for advantageous metabolic adjustments. Emphasis will still be maintained on running technique, suppleness and uphill running during this period.

Figure 38 Pulse Table (from Lenzi 1983 and quoted from Alford 1983 pp 64).



5.4 Long Term Planning.

Assuming that a young athlete commences some form of athletic training at 12 years of age the development of endurance might follow the phases suggested hereunder (from Bompa 1983).

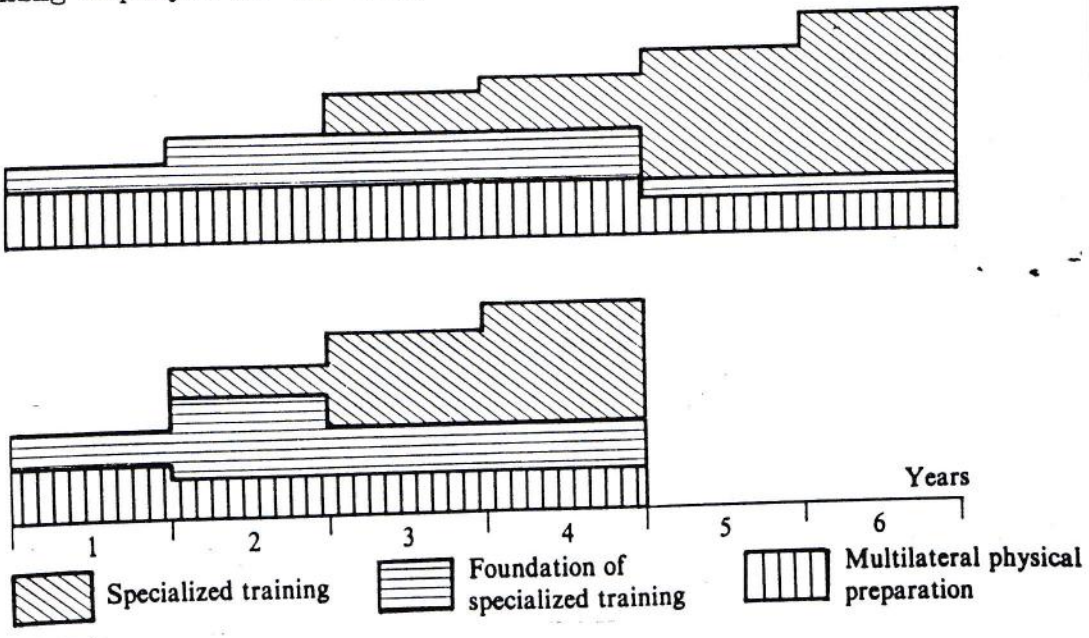
Age.	
12-16 years	General endurance.
17-18 years	Develop the foundation of specific endurance.
19+ years	Specific endurance.

Long term planning has to establish its objectives and direction and as such the following have to be taken into account.
(a) The number of systematic training years necessary for the

prospective athlete to obtain high performances;
(b) the average age at which top performances are achieved;
(c) what natural abilities the prospective athlete starts with; and
(d) the age at which one starts specialized training.

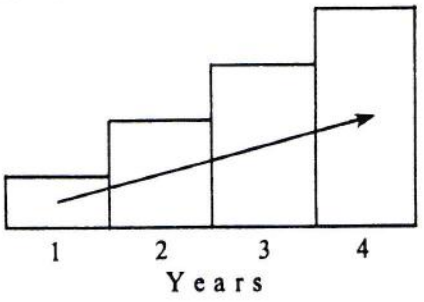
5-7 years is normally required to reach top levels depending on when the athlete starts training. Optimal levels for motor and physiological functions are between the ages of 25-30 years for men and 3-5 years earilier for women (Ozolin 1971 and quoted from Bompa 1983). Endurance events are performed at an optimal level in excess of 30 years of age ie Coe and Ovett, particularly Lopes in the marathon. The rate of an athletes improvement is not linear. It will be much higher in the beginning and during the phase of specialization. It tends to slow down throughout the phase of high performance. Long term planning needs to consider the athletes age. For younger athletes the plan might be of 6-8 years duration. For juniors (over 16 years) and elite athletes a 4-year plan might be more suitable. The diagram hereunder reflects the various types of training the base of which provides a general type physical preparation on top of which is added the foundation for specialized training. This in turn facilitates highly specialized training to cater for the specific needs of the event. Work is increased on an annual basis as does the ratio between the different types of training.

Figure 39 The Inter-Relationship Between Different Types of Training Employed in the Long Term Plan (from Bompa 1983 pp 191).



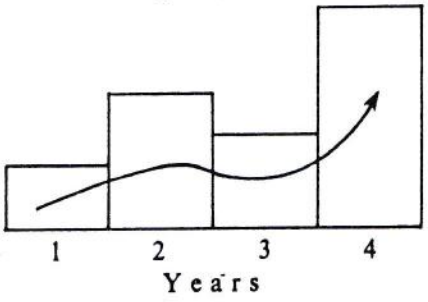
The Olympic cycle comprising 4 years should be used as a segment of the athletes long term plan. Non Olympic athletes can also use this system to better organize their long term planning. There are two ways of approaching this type of planning. The first is the monocyclic approach a diagram of which appears hereunder. The various training factors and components are increased progressively each year. The disadvantage is that it places the athlete under a continuous elevation of stress.

Figure 40 The Illustration of a Monocyclic Approach (from Bompa 1983 pp 196).



However in the bicyclic approach the coach can increase the load in an undulating manner as shown hereunder.

Figure 41 The Elevation of Training Load and the Curve of Stress in the Bicyclic Approach (from Bompa 1983 pp 196).



It is fairly common that in the post-Olympic year the intensity and stress of training is lowered and some regeneration is achieved. This provides the basis for the second year where the intensity will be elevated in terms of volume of training. High performances will be expected as a result of this training

allowing the coach to assess the athletes progress half-way through the cycle. This approach should only be used by athletes who have reached optimal age for their particular event and must be based on a strong background of work. Younger athletes should adhere to the monocyclic approach seeking gradual annual improvement up to the maturation age in their chosen event. The plan becomes increasingly more complicated with other major championships falling within the 4-year cycle ie Commonwealth, European and World Championships etc. In such circumstances regeneration periods might have to be carefully organized during the transition phases of the annual periodized year.

Chapter 6

The Nature of Training Schedules.

6.1 800m

- Sebastian Coe.

6.2 1500m

6.2.1 - Schedules prepared by Harry Wilson.

6.2.2 - John Walker.

6.3 3000m Steeplechase

6.3.1 - Anders Garderud.

6.3.2 - Henry Marsh.

6.4 5000m

- David Moorcroft.

6.5 10,000m

- Alberto Cova.

6.6 Marathon

- Robert de Castella.

It is intended that this Chapter act as a digest of training practice. As such the information contained herein has been extracted verbatim from a number of sources.

It may help fulfil the role of a reference point for the illustration of training sessions for each of the endurance events as they apply to elite athletes. It will also help in asking the question whether the theoretical model fits that of the practical model and if not, why not ?

It is accepted that the models provided are, in a sense, ideal ones and do not relate to how the overall training might be re-structured in the event of injury or when part of the preparatory build-up period is lost.

The following training schedules for the athletes listed hereunder are illustrated within this Chapter.

800m	Sebastian Coe
1500m	Schedules prepared by Harry Wilson John Walker
3000m Steeplechase	Anders Garderud Henry Marsh
5000m	David Moorcroft
10,000m	Alberto Cova
Marathon	Robert de Castella

6.1 800m.

Sebastian Coe (from Peter Coe 1983 and quoted from Alford (Ed) 1983 pp 5-15/from Brook 1984 in Athletics Coach).

The aerobic component of his training is taken up with long slower runs over 12 miles and medium steady state runs over 6-9 miles. High intensity aerobic runs are done using the following methods.

4 x 1600m or 3 x 2000m runs at 5000m pace using a recovery ratio of 1:1 and 1:½

Fartlek sessions are included with hilly sections en route. Anaerobic training might include the following sessions.

4 x 400m at 800m pace using a recovery ratio of 1:1 or 300m; 2 x 200m; 4 x 100m and 8 x 60m at 400m pace using a recovery ratio of 1:2.

Figure 42 A Summary of the Phases and Training Emphasis Put Forward by Peter Coe for an 800m/1500m Runner (from Brook 1984 Athletics Coach).

PHASE	TRAINING EMPHASIS
1. Oct	Easy running programme 3.30/kilometre
2. Nov - Jan	5000m type running - 5 x 9-14 km/week - 1 x 16-19 km/week Interval Running - 800m - 1000m Reps 5 min rec. - 100m - 800 short rec.
3. Feb - April	Multi-Tier Running i.e. 5000m, 3000m, 1500m, 800m, 400m } PACE REPETITIONS. EVERY SECOND DAY. 1 x 16 - 19 km/week Hill Runs - Long & Short Reps (anaerobic) 3-4 x 6.5-8 km run/week (3.20 - 3.30 pace)
4. April - June	Multi-Tier Running Fartlek Road Runs

The following is the 5-tier training system originally developed by Frank Horwill but refined in this instance to suit the requirements of Sebastian Coe.

Figure 43 Five Tier Training (from Brook 1984 Athletics Coach).

FIVE TIER TRAINING

4-5 LEVELS OF TRAINING OVER 10-14 DAYS

E.	SUNDAY	— 4 × 1,600 METRES or 3 × 2,000	5,000m Pace
2.	MONDAY	— FARTLEK	
3.	TUESDAY	— 8 × 800	3,000m Pace
4.	WEDNESDAY	— ROAD	
5.	THURSDAY	— 16 × 200m	1,500m Pace
6.	FRIDAY	— REST IF RACE IF NOT RACING — FARTLEK	
7.	SATURDAY	— RACE OR TIME TRIAL	
8.	SUNDAY	— 4 × 400	800m Pace
9.	MONDAY	— ROAD RUN	
10.	TUESDAY	— 1 × 300, 2 × 200, 4 × 100, 8 × 60	400m Pace
11.	WEDNESDAY	— FARTLEK	
12.	THURSDAY	— RACE OR CHOOSE PACE FOR NEXT RACE (800 PACE FOR 1,500 RACE) (400 PACE FOR 800 RACE), (1,500 PACE FOR 5,000 RACE)	

6.2 1500m.

6.2.1 Schedules Prepared by Harry Wilson (quoted from Alford 1983 pp 17-22).

The Autumn/Winter phase usually commences mid-October after a break of 2-4 weeks. Training will follow the sequence itemised hereunder.

- 1 x steady state run each day of 4-6 miles for 3-4 weeks totalling an average of 40 miles per week.
- Add a second session to the day so that by the end of December 80 miles per week is being done in 12-14 sessions.
- Sessions should be done with short, fast runs over 4 miles and long, steady runs over 12 miles.
- 1-2 sessions of long repetitions each week with short recoveries ie 4-5 x 1500m or 6-8 x 1000m over hilly road or grass circuits with 30sec recovery.
- Sprint drills which include high knee lifts, heel kick-ups, acceleration runs, stride changes and flat-out efforts.
- A low key cross country race over 10kms every 3 weeks.
- The programme of 80 miles per week is maintained for 3-4 weeks followed by 4 weeks of higher mileage (100mpw). One aerobic repetition session is dropped for hill running with 6-8 reps of 75-90secs duration on a fairly shallow incline. There is a jog back recovery in 90secs.
- The period is followed by a reduction in mileage to 80mpw and an increase in the pace of the shorter, steady state runs in order to peak for the major cross country races.
- Major cross country race(s).
- Easy week of relaxed running before starting the next phase.
- During this phase 2 easy weeks will have been introduced at 5-week intervals to provide a break thus avoiding injury and mental staleness.

During the Spring/Early Summer pre-competition period the following is a typical week of training.

- Anaerobic work is gradually introduced and the programme reflected overleaf is maintained until the start of the competition phase (usually the beginning of June).

- A 2-week cycle is usually followed where the athlete places emphasis on certain sessions in the one week and then emphasis on the other sessions in the second week.

Monday to Friday — 5-7 miles each morning — pace dependent on the athlete's feelings each day.

Monday	8 runs up hill — fairly shallow hill — 60/70 seconds each run, quick jog back between.
Tuesday	8 mile steady run.
Wednesday	5 sets 3 × 200m. (25/26 seconds), 30 seconds rest between each run: 3 minutes rest between sets. 30 minutes sprint drills.
Thursday	4 × 500m. (65/66 seconds), 2½/3 minutes recovery between each.
Friday	5 miles fairly fast run.
Saturday	AM — 8 miles run. PM — 4 × 1000m. round hilly circuit, 1½/2 minutes recovery between each. 30 minutes Sprint drills.
Sunday	AM — 10 miles steady run. PM — 8 × 200 fast relaxed runs — 200 jog between each.

We usually spend two weekends training on sand dunes and beaches in South Wales during March and April.

Competition Period.

- Training is built around the racing programme.
- Achieving a good session in a relaxed manner knowing there is something in reserve.
- The following are two different types of programmes during this period where one athlete likes to race every week and the other once every three weeks.

Athlete A — likes to race every week.

5-7 miles run each morning.

Afternoon sessions:

Sunday	5 miles Fartlek
Monday	6 long hill runs. Sprint drills.
Tuesday	4 × 400m. — fast but relaxed — 3-4 minutes recovery between.
Wednesday	4 sets 2 × 300m. (37/38), 30 seconds between each, 5-6 minutes between sets. Sprint drills.
Thursday	6 miles easy run.
Friday	Easy relaxed strides over 100m.
Saturday	Race.

Athlete B — likes to have a race once every three weeks.

Non-racing week.

5-7 miles run each morning Monday to Friday.

Sunday	AM — 10 miles steady run. PM — 8 × 200 easy relaxed runs, 200 walk/jog between.
Monday	PM — 3 × 1000m. — hilly circuit — 4/5 minutes rest between.
Tuesday	PM — 6 miles steady run.
Wednesday	PM — Race Practice — 6 × 600 (400 relaxed, say 60 seconds, then 200 as fast as possible), 3-4 minutes rest between each.
Thursday	PM — 400m. fast, 30 seconds rest, 100m. fast. Repeated 4 times with 5 minutes rest between each.
Friday	PM — 6 miles steady run.
Saturday	AM — 5 mile Fartlek. PM — 6 × 300m. (100 stride, 100 sprint, 100 stride), 3/4 minutes rest between each. Sprint drills.

6.2.2 John Walker (quoted from TT Staff 1976 in Athletics Weekly and F. Wilt 1976 in Track Technique).

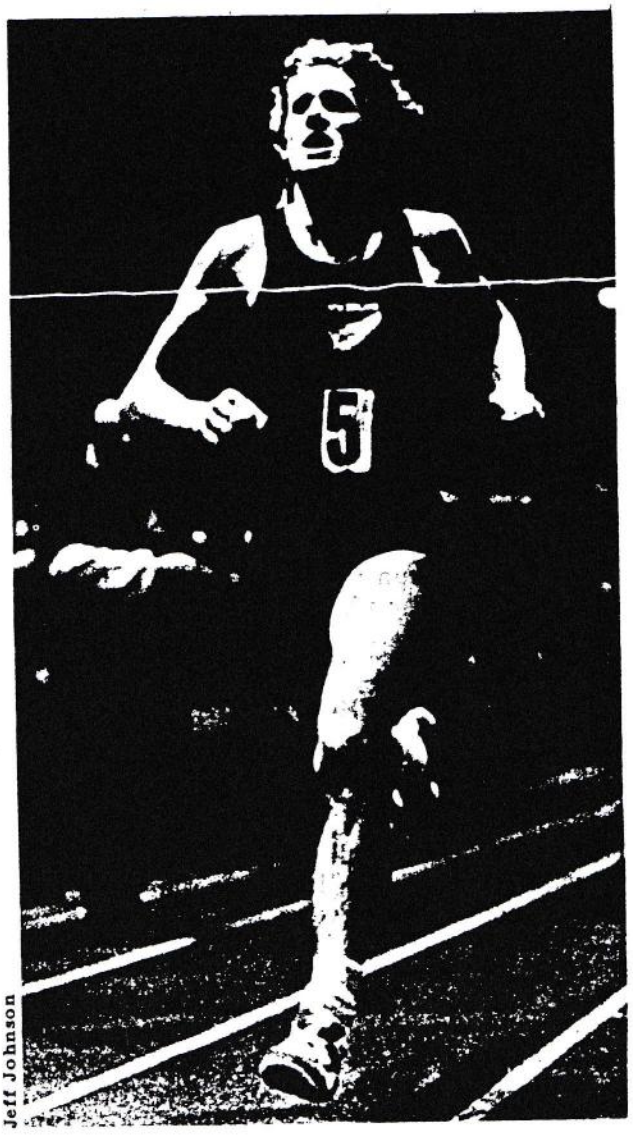
John Walker

by *TT* staff

Born: January 12, 1952. Ht/Wt: 6-¼/165; 1.835/75.

Background: Walker is the current world recordholder in the mile, with a 3:49.4 mark. Began competing at the age of 12; first started serious training at age 18. Ranked first in the world in the 1500/mile by *Track & Field News* in 1974 and 1975. Athlete of the Year in 1975.

Best Marks: 800m, 1:44.9; 1500, 3:32.4; 3000m, 7:40.6; mile, 3:49.4 WR.



Jeff Johnson

ANNUAL PROGRESSION

Year	Age	Events	Best Marks
1971	19	800,1500,mile	1:49.0, 3:52.6, 4:09.0
1972	20	" " "	1:48.1, 3:43.3, 3:58.8
1973	21	" " "	1:46.3, 3:38.0, 3:55.5
1974	22	" " "	1:44.9, 3:32.5, 3:54.9
1975	23	" " "	1:45.9, 3:32.4, 3:49.4

Walker trains year-round, "barring injury." He follows no regular warmup or warmdown before or after meets or workouts. He does, however, usually do 15 minutes of hard jogging and six hard strides until he breaks a sweat. Before competition, Walker tries to relax as much as possible; he goes for a jog in the morning, eats a good meal, then usually sleeps for about 2 hours. He does not follow any particular diet, commenting, "I never worry about weight. I eat any type of foods." He goes to bed late and sleeps in late. Walker also works an 8 hour day and feels that it is important to do something else besides run.

John Walker does no weight-training. John believes his greatest strength to be his ability to run long distances at a fast pace. In his training schedule, he runs from 10 to 23 miles, *never any slower than 6:05 pace.* "It is not technique but the ability to push yourself hard in training, working the body, but not straining, to run within yourself" which is the key, according to Walker. "But this cannot be achieved straight away: it usually takes 3 to 4 years solid mileage to get there." With his acquired strength, John is able to compete in more than 50 outdoor meets per year against top-flight competition.

On his training program, Walker notes that his training weeks vary, but "everything is done faster than most athletes train; I train to how I feel and not to what a schedule says to do."

The following training weeks are taken from halfway through Walker's training program.

NON-COMPETITIVE SEASON

Mon—One run only, 10 miles easy in about 56 minutes; on grass and flat, incorporating hills working the last 5 miles, "but not straining Only one run, especially after the weekend."
Tues—11 miles on hills, running the flats hard

6.2.2 John Walker (quoted from TT Staff 1976 in Athletics Weekly and F. Wilt 1976 in Track Technique).

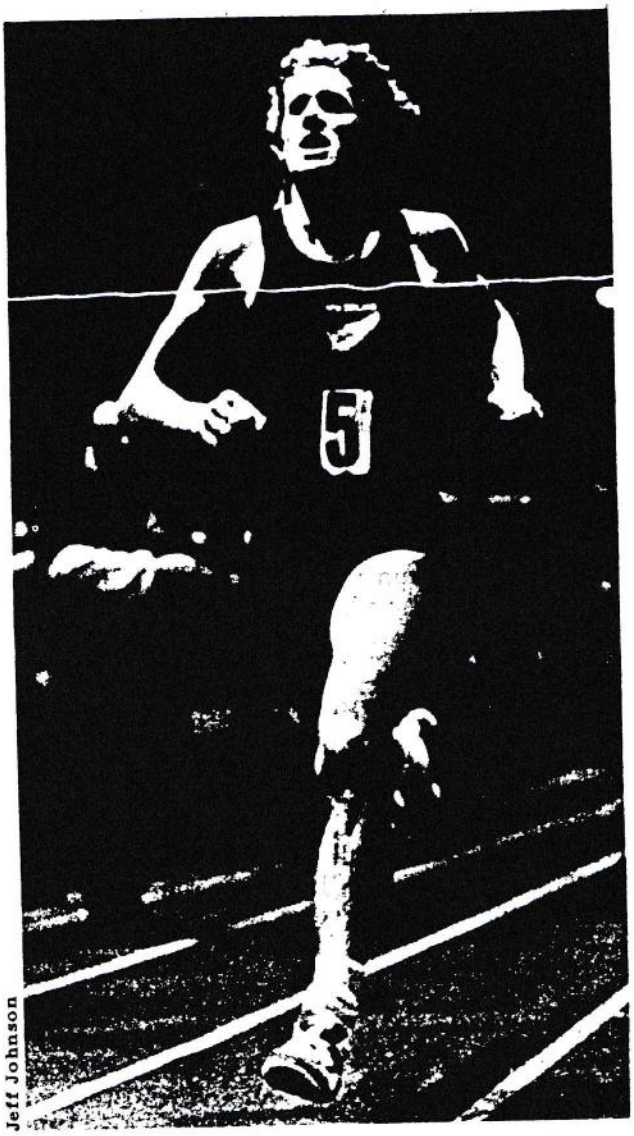
John Walker

by *TT* staff

Born: January 12, 1952. Ht/Wt: 6-¼/165; 1.835/75.

Background: Walker is the current world recordholder in the mile, with a 3:49.4 mark. Began competing at the age of 12; first started serious training at age 18. Ranked first in the world in the 1500/mile by *Track & Field News* in 1974 and 1975. Athlete of the Year in 1975.

Best Marks: 800m, 1:44.9; 1500, 3:32.4; 3000m, 7:40.6; mile, 3:49.4 WR.


Jeff Johnson

ANNUAL PROGRESSION

Year	Age	Events	Best Marks
1971	19	800,1500,mile	1:49.0, 3:52.6, 4:09.0
1972	20	" " "	1:48.1, 3:43.3, 3:58.8
1973	21	" " "	1:46.3, 3:38.0, 3:55.5
1974	22	" " "	1:44.9, 3:32.5, 3:54.9
1975	23	" " "	1:45.9, 3:32.4, 3:49.4

Walker trains year-round, "barring injury." He follows no regular warmup or warmdown before or after meets or workouts. He does, however, usually do 15 minutes of hard jogging and six hard strides until he breaks a sweat. Before competition, Walker tries to relax as much as possible; he goes for a jog in the morning, eats a good meal, then usually sleeps for about 2 hours. He does not follow any particular diet, commenting, "I never worry about weight. I eat any type of foods." He goes to bed late and sleeps in late. Walker also works an 8 hour day and feels that it is important to do something else besides run.

John Walker does no weight-training. John believes his greatest strength to be his ability to run long distances at a fast pace. In his training schedule, he runs from 10 to 23 miles, *never any slower than 6:05 pace.* "It is not technique but the ability to push yourself hard in training, working the body, but not straining, to run within yourself" which is the key, according to Walker. "But this cannot be achieved straight away: it usually takes 3 to 4 years solid mileage to get there." With his acquired strength, John is able to compete in more than 50 outdoor meets per year against top-flight competition.

On his training program, Walker notes that his training weeks vary, but "everything is done faster than most athletes train; I train to how I feel and not to what a schedule says to do."

The following training weeks are taken from halfway through Walker's training program.

NON-COMPETITIVE SEASON

Mon—One run only, 10 miles easy in about 56 minutes; on grass and flat, incorporating hills working the last 5 miles, "but not straining Only one run, especially after the weekend."
Tues—11 miles on hills, running the flats hard

Wed—18 miles, one run, usually averaging under 6:00 pace; over hills and flat, all done on the road.
Thurs—11 miles in morning at "reasonable" pace. PM, 7 miles hard.
Fri—Easy day; 10 miles on grass; one run.
Sat—15 miles on flat road in about 1:21:00.
Sun—18 to 23 miles, really hard hills around Waitarua (Snell's course), usually maintaining 6:00 pace.

Walker comments that the above training mileage (105) was only recently reached. Before, he used to run twice per day, except Sunday, and average about 90-95 per week for 7 weeks.

COMPETITIVE SEASON

Mon—AM, 10 miles fast. PM, 2M at reasonable pace, 8:40-8:47.
Tues—AM, 8 miles in hills. PM, 6 x 200 in 26.
Wed—AM, 8 miles fast. PM, 2M in 50 x 60y reps really hard; *or*, 6 x 400 in 55-57.
Thurs—AM, 8 miles. PM, 2 x mile in 4:03 average, 3M in 13:40; *or*, 15 x 200 in 26 average; *or* 6 x 400 in 55-57.
Fri—AM, 8 miles. PM, 8 x 150 fast.
Sat—Race, or time trial over 600 or 800m; or 15 x 400 averaging 61.
Sun—18 mile run at good pace (1:44.00), usually a lot of hills included.

On going all-out in training, Walker says: "I find it impossible to run flat out. I need competition to achieve full results. I usually train at ¾ pace so I'm not leaving all my training on the track."

Since 1971, Walker has been coached by Arch Jelley of Aukland, New Zealand. Following is presented the training theory on which John's workouts are based, plus actual samples of workouts done by Walker in 1975:

Walker has trained all the year round since October 1971 except for when he has been indisposed or injured. He does not train for cross country but did run in 3 cross country races in 1975. All his training is geared for outdoor track running with two distinct seasons of track racing each year.

Walker races in Europe and in New Zealand for a total of between 50-60 races per year. He also races indoor in the States for a limited number of races but he does not regard this in a serious light. His usual cycle of training goes something like this:

1. **Build Up** (a) Stamina (6-8 weeks); (b) Speed (4-6 weeks).
2. **Racing** (8-10 weeks).
3. **(Easing off Period** (2-5 weeks).

After his easing-off period he starts in immediately on the stamina part of his build-up again.

When compared with some New Zealand greats of the past, Walker has not been a high mileage man.

The following table illustrates this fact:

	1973	1974	1975
Build Up			
(a) Stamina	5 wks at 68	6 wks at 78	5 at 92
(b) Speed	7 wks at 57	6 wks at 84	5 at 80
Racing	9 wks at 36	10 wks at 49	10 at 44

His speed work, which is of the Lydiard type but tailored to suit him and the circumstances, is accompanied by a fair mileage done at a good speed. Up until 1975 the speed section of his Build-Up often contained higher mileage than the Stamina section of his Build-Up.

John started off in 1971 by doing the Lydiard-type hill schedule but recurring knee injuries have meant that this specialized type of hill work has been abandoned since the 1971-72 season. John used to do his steady type running at about 6:30 pace but now he would seldom train slower than 5:30 mile pace. His mileage has gradually been increased over a 4-year period so that now for the first time he is handling in Stamina Build-Up a mileage of approximately 100 per week. Some of this is done in two sessions per day of quality running but very recently John has been running only once daily. He has never worked with weights but is naturally a very strong, tough, well built, muscular athlete. He does stretching and suppling exercises briefly each day and especially before any speed sessions.

Build-Up (Stamina) Period (April 1974):

Monday—AM, 9.5 miles steady..PM, 6.5 miles steady. Tuesday—AM, 9 miles steady. PM, 7.2 miles steady. Wednesday—AM, 8 miles steady. PM, 7 miles. Thursday—AM, 8 miles. Friday—AM, 9 miles. Saturday—AM, 10 miles. Sunday—AM, 16 miles on hilly cross country course.

Second Example of Build-Up (Stamina) (Nov. 1975):

Monday—15 miles, steady. Tuesday—10-mile fartlek. Wednesday—18 miles on road (hilly), 1 hour, 39 minutes. Thursday—12 miles steady. Friday—9 miles steady. Saturday—22 miles on road (hilly), 2 hours, 12 minutes. Sunday—15 mile jog.

Build-Up (Speed) Period—Mileage 75-80 mpw (May 1975):

Monday—AM, 7½ miles on road in 42 minutes. PM, 3200m in 8:46. Tuesday—AM, 7½ miles

steady. PM, 8 x 200 in 27.1 average, 200 jog recovery. Wednesday—PM, 8 x 150 stride-outs untimed; 400 in 53 seconds. Thursday—AM, 8½ miles steady. PM, 1600m in 4:05.6 at ¾-effort; 15-minute jog; 1600 at ¼-effort in 4:14. Friday—PM, 4 x 150 untimed stride-outs. Saturday—AM, 2-mile jog. PM, 1500m relay leg in 3:36+ in attack on world record.

Second Example of Speed Build-Up (June 1975):

Monday—AM, 8-mile steady on road in 44 minutes. PM, 8 x 300 in 40.5 with the fastest in 39.8, 300-meter jog between. Tuesday—AM, 8 miles on roads. PM, 600m in 1:19.2 (goal 1:20.0). Wednesday—AM, 8½ miles steady on roads. PM, 8 laps of 50/60 yard dashes (4 in each lap; each lap 69-70 seconds); fast stride for 50, followed by a 60-yard float. Thursday—AM, 6 miles steady. PM, 6 x 400m in 57.1. 400m jog recovery. Friday—Rest. Saturday—2-mile jog; 2 x 200m stride-outs; 1000m trial in 2:21 (aiming at 2:24). Sunday—18½ miles on hilly roads.

Example of Racing Period (June 30 to July 6th 1975):

June 30—Mile race in 3:52.2; 4-mile jog. July 1—7½-mile jog. July 2—1000m race in 2:17.2. July 3—6½-mile jog. July 4—2000m race in 5:00.6. July 5—AM, 8½-mile jog. PM, 5½-mile jog. July 6—7-mile jog.

Example 2 of Racing Period (Leading up to 3:49.4 mile):

Aug. 6—6-mile jog in 36 minutes. Aug. 7—800m race in 1:46.5 (3rd). Aug. 8—8-mile jog. Aug. 9—5 x 200m strideouts, varying from 25.7 to 30.0. Aug. 10—2 x 200 in 23.0 and 22.9; 300 in 38.4, 2 x 150 in 15.1. Slept 10½ hours. Aug. 11—Jogged 4-5 miles and did a few easy untimed stride-outs. Aug. 12—AM, 20 minutes easy jogging plus a few stride-outs. PM, mile in 3:49.4 WR.

During the racing session Walker usually does light speed work with jogging on alternate days and regards racing as one of the most important forms of speed work and almost always tries to win a race without worrying unduly about the time.

6.3 3000m Steeplechase.

6.3.1 Anders Garderud (from Rowlands 1976 in Athletics Weekly).

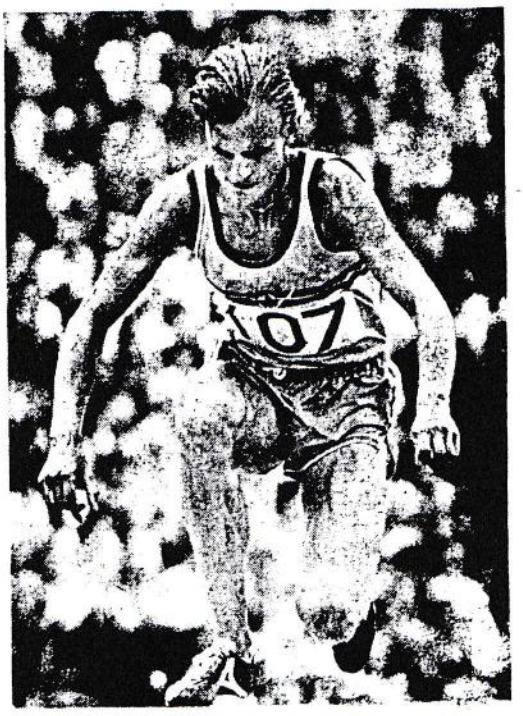
Garderud's Training For The 1976 Olympics

Supplied by Mike Rowland

PERIOD 1: Preparation for basic training (October 20th — November 23rd 1975; 33 days).
PERIOD 2: Basic Training (November 24th 1975 — April 19th 1976; 147 days).
PERIOD 3: Hill Training (April 20th — June 21st; 63 days).
PERIOD 4: Special Training (June 22nd — July 20th; 29 days).
PERIOD 5: 'Charging Up' (July 21st — July 28th; 7 days).

RACE PLAN (IF POSSIBLE)

Approx Date	Event	Anticipated Result
June 1st	10,000	28:25
June 8th	5000	13:45
June 15th	5000	13:35
June 22nd	3000SC	8:23
June 29th	1500	3:39
July 5th	1500	3:36
July 12th	5000	13:20



ANDERS GARDERUD
George Herringshaw

PERIOD 1: October 20th — November 23rd
Run at an easy tempo. Morning training for the greater part in the woods. Afternoon or evening runs on gravel or asphalt. Successive increases in quantity.

Week 43-44: 140km per week broken up into ten runs, one at 30km and one at 20km (throughout period one). Week 45: increase to 150km. Week 46: increase to 160km. Week 47: increase to 170km (106 miles).

PERIOD 2: November 24th — April 19th
Constant increase in quantity until January 25th with a three week 're-charging' period at the end of the year*. Twelve or thirteen training runs per week. Continue running at easy tempo until and including week 51. The first fast running comes in week 52 and consists of a 15km run at hard even speed. Week 1 (first week of January 1976): increase fast running with one hard even speed run of 10km. Week 2 sees the inclusion of a hill session as preparation for forthcoming hill work. These three quality runs are repeated in week 3. The quality runs at 10km and 15km

should improve with successive weeks until Period 2 is over (April 19th), these runs then being displaced by aerobic running.

*The re-charging period must be weeks 51 and 52 of 1975 and week 1 of 1976; Mike Rowland comments — "this I find strange since he ran 200km (125 miles) per week and didn't reduce at all".

Week 48 — 180km	Week 52 — 200km
Week 49 — 180km	Week 1 — 200km
Week 50 — 190km	Week 2 — 210km
Week 51 — 200km	Week 3 — 210km

During the first four weeks the quantity should alternate from 30km, followed by 10km, etc. During the last three, both fast and long runs alternate, eg 10km hard followed by 20km at slow pace. Weeks 4-16 held constant with once every other week a 28km hard run instead of a 10km or 15km hard. The vital thing is that these three hard runs never follow each other but are followed by two easy runs. Morning running; 1-1½ hours easy running.

PERIOD 3: April 20th — June 21st

Main principle: every other day hill training with increase in number of hills and repetitions. Warm up and jog after hills, usually 45 mins.

200m hill
4 × hill + 4 × 100m
4 × hill + 4 × 200m
5 × hill + 5 × 100m
6 × hill + 4 × 100m
6 × hill + 4 × 200m

250m hill
4 × hill + 4 × 100m
5 × hill + 5 × 100m
4 × hill + 3 × 300m
4 × hill + 4 × 300m
5 × hill + 4 × 300m

300m hill
4 × hill + 4 × 100m
4 × hill + 5 × 100m
5 × hill + 4 × 100m
5 × hill + 5 × 100m

On the days between hill work — fartlek running, but with no requirements on speed. Tempo and speed stretch will depend upon how the previous day's hill work has affected the body. Morning run of 45-60 mins, letting body dictate tempo of run. Fartlek distances usually about 10km.

The first weeks — run 4 hills and 100m reps. Increase load until the period's end to 5 hills and 300m reps or 6 hills and 200m reps.

Between reps, jog back to start. Run at 75% maximum tempo, ie 100m in approx 15 sec, 200m in approx 30 sec, 300m in approx 47 sec.

Once a week during period 3 run 30km at easy speed — 2 hr 10 min. Most vital during this period: 100% work into each hop. (Mike Rowland explains — "Most Swedes seem to do Lydiard's type of bouncing uphill. During a TV interview with Garderud prior to the Olympic Games he was seen bouncing up hills in training. Swedes that I spoke with claimed that the athlete

A dazzling future was predicted for Anders Garderud when he front-ran to victory in the European Junior 1500m steeplechase in 1964 and a year later, aged 19, clocked the remarkable time of 4:00.6 for that event. The lanky Swede did indeed make good as a senior in terms of producing fast times — on the flat as well as for the steeplechase — but for much of his career he was regarded as a poor competitor on the big occasion. He was eliminated in the heats at the 1966 European Championships and at the Olympics of 1968 and 1972, while he 'choked' again in the 1971 European steeplechase final to place 10th after clocking the fastest heat time.

He put up a better showing at the next edition of the European Championships, in 1974, to finish second behind his arch-rival Bronislaw Malinowski (Poland), and the following season he achieved a measure of immortality by becoming the first to break 8:10 for the 3000m steeplechase.

However, it was not until the 1976 Olympics that Garderud finally, and decisively, convinced doubters that he was temperamentally as well as physically equipped to land the supreme prize. Bursting ahead of Malinowski with 300m to go, he raced to the gold medal in a world record 8:08.0. Whether Frank Baumgartl (E. Germany), who was level with Garderud when he fell at the last barrier, would have won but for that mishap will long be discussed, but — as Baumgartl himself said — "the simple fact is Anders won the race".

Best marks include 1:47.2 for 800m, 3:36.7 for 1500m, 3:54.5 for the mile, 7:47.8 for 3000m, 13:17.6 for 5000m, 28:59.2 for 10,000m and 8:08.0 for the steeplechase. Annual progress at steeplechase: 1965-8:59.4; 1966 to 1968-flat racing only; 1969-8:38.6; 1970-8:45.6; 1971-8:28.4; 1972-8:20.8; 1973-8:18.4; 1974-8:14.2; 1975-8:09.8; 1976-8:08.0. He was born in Stockholm on August 28th 1946.

Reprinted from Mel Watman's "Encyclopaedia of Athletics", available from the 'AW' Book Dept, price £5.

GARDERUD'S RACING BUILD-UP TO MONTREAL

June 1st, Gothenburg: 1500 — 3:40.4 (1). **June 3rd,** Helsinki: 5000 — 13:44.6 (1). **June 8th,** Stockholm: 3000SC — 8:15.5 (1). **June 15th,** Stockholm: 3000SC — 8:26.8 (1). **June 17th,** Vasteras: 5000 — 13:44.4 (2). **June 23rd,** Helsinki: 3000SC — 8:16.7 (1). **June 29th,** Stockholm: 3000SC — 8:33.6 (1). **July 5th,** Stockholm: 5000 — 13:17.6 (4). **July 7th,** Nykoping: 3000 — 7:55.6 (2). **July 25th,** Montreal: (Olympic 3000SC heat) — 8:21.4 (3). **July 28th,** Montreal: (Olympic 3000SC final) — 8:08.0 (1) (World record).

achieves 100% work load during the bounce, which one wouldn't get if one simply ran uphill. Not so convinced myself'').

PERIOD 4: June 22nd — July 20th

Main principles of period 4: successive increases in tempo of reps — follow schedule precisely with exact timekeeping. First two weeks of period: one hill session per week (4 × 200m hill plus 4 × 100m reps). Run at least one 20km during this period.

	Week 1	Week 2	Week 3	Week 4	Rest
Tartan/20 × 200	30sec	29sec	28sec	27sec	45sec
Tartan/10 × 400	60sec	59sec	58sec	57sec	60sec
Grass/10 × 100	Maximum tempo — free downhill				120sec

Example: June 20th — Fartlek 10km; **21st** — 20 × 200m × 30 sec; **22nd** — 10 × 100m; **23rd** — Hill Work; **24th** — 20km; **25th** — 10 × 400m × 60 sec; **26th** — Race 1500m; **27th** — Fartlek 10km; **28th** — 20 × 200m × 29 sec; **29th** — 10 × 100m; **30th** — Hill Work; **July 1st** — 20km; **2nd** — 10 × 400m × 59 sec; **3rd** — Race 1500m.

PERIOD 5: July 21st — July 28th

The last week before the Olympic steeplechase heats in Montreal:—

Day 1 — 40 min on grass. **Day 2** — 20 min on grass; 10 × 100m on Tartan; 20 min on grass. **Day 3** — 20km on golf course or in woods. **Day 4** — 20 min on grass; 10 × 100m on Tartan; 20 min on grass. **Day 5** — 15km on golf course or in woods. **Day 6** — 30 min on grass. **Day 7** — Race.

Mike Rowland comments: ''Garderud developed a leg injury in Montreal and according to Swedish media didn't do any track training. This may have helped to take the pressure off him''.

6.3.2 Henry Marsh (from Kernan 1978 in Track Technique).

Henry Marsh

by John Kernan

Born: March 15, 1954. Ht/Wt: 5-10/158, 1.78/71.5.

Background: Marsh began 1976 with a steeplechase best of 9:25.0, but by the time the Olympics were done he had slashed that by over a minute, placed 10th in the Games, and become the second-fastest American ever. An American record followed in 1977, and in 1978, as a new member of the Eugene-based Athletics West club, he took his first national title and later took the dual meet against the Soviet Union.

Best Mark: 8:21.6 steeplechase.

ANNUAL PROGRESSION

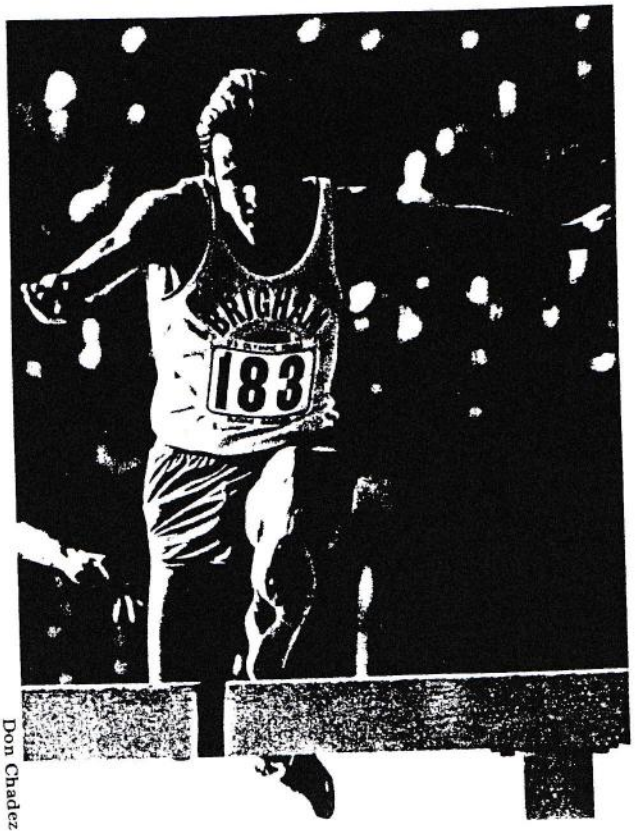
Year	Age	Affiliation	Best Marks
1970	16	Texas HS	4:24, 9:38 2M
1971	17	Hawaii HS	4:18
1972	18	" "	4:29, 9:40 2M
1973	19	BYU	9:25 steeple
1974-75	No competition		
1976	22	BYU	8:24.0
1977	23	"	8:21.6 AR
1978	24	"	8:22.5

Henry states, "I believe that each individual is unique and needs personalized workouts." He follows a hard-easy program of training.

COMPETITIVE SEASON

Mon—8-9 mile run.
Tues—AM, 5 mile run; PM, 2 x 880 (2:12, 2:14), 1 x 440 (57).
Wed—AM, 6 mile run; PM, 8 x 220 (29 down to

26), 4 x 440 (63, 64, 64, 61).
Thurs—AM, 4 mile run; PM, 4 mile run.
Fri—AM, 3 mile run. PM, 2 mile run.
Sat—Race.
Sun—Rest.



Don Chadez

HENRY MARSH

NON-COMPETITIVE SEASON

Mon—AM, 3 mile run; PM, 2 x 1320 (3:27) and 2 x 880 (2:14) over hurdles and water jump, 1 x 880 (2:11) and 2 x 440 (68).
Tues—AM, 5 mile run; PM, 3 x 440 (68) over hurdles and water jump.
Wed—9-10 mile run.
Thurs—AM, 5 mile run; PM, 3 x 440 (68, 67, 66) over hurdles and water jump.
Fri—AM, 4 miles easy; PM, 4 miles easy.
Sat—AM, 6 mile run; PM, 1 x mile (4:56), 1 x 1320 (3:33), 1 x 880 (2:18), and 1 x 440 (63).

While at BYU, Marsh trained at an altitude of 4500 ft., thus making his workouts more strenuous than the times indicate.

"My main philosophy," says Henry, "is training according to how I feel. I believe that it is best to center the week's workouts around 3, possibly 4 hard workouts."

Henry pretty well sums up his attitude with the statement, "It's not how far or what you run, but how you run it."

6.4 5000m.

David Moorcroft (from Anderson 1983 and quoted from Alford (Ed) 1983 pp 23-27).

The aerobic component of his training is taken up with long, slower runs of 15 miles and medium, steady state runs over 8-12 miles. High intensity aerobic runs are done using 4-6 x 1000m with a 6½min recovery. Moorcroft includes short, fast runs of between 3-6 miles and also fartlek sessions which include hilly sections.

The anaerobic training will include sessions of 8 x 300m with 3mins recovery or 3 x 4-6 x 150m with 90secs recovery between reps and 5mins between sets.

Figure 44 A Summary of the Aerobic/Anaerobic Training Undertaken by David Moorcroft during the 1981-2 Season (from Anderson 1983).

PHASE	TRAINING EMPHASIS
Autumn/Winter (Oct - Mar)	Milage 40 80 100 80 Steady 4-6 mile runs 5-7 mile runs Short 4 mile run Long 12 mile run Long Repetitions 4/5 x 1500 6/8 x 1000 Hills - Shallow 6/8 x 75 - 90s with 90 secs rec. Cross-Country Races - 6 miles
Spring/Early Summer (Apr - Jun) "Pre-Competition"	Steady Run 5-7 miles each morning 1 x Hill Session - Shallow 400/500m - Steep 100/150m 1 x Long Repetition i.e. 4 x 1000m fast with medium recovery. 2 x Short intensive speed endurance i.e. 5 x (3 x 200). 2 x Long Steady state runs 1 x Speed work.
ummer (Jun - Sept) "Competition"	Based on competition programme

Anderson stressed the great emphasis on aerobic training as part of Moorcroft's move up from 1500m to 5000m running.

FIGURE 1

Schedule Composition

By way of comparison, one of the very early training schedules which was presented to David Moorcroft, in fact in May, 1969, when he was 16 years of age, was as follows:

Monday	—	1 hour Fartlek
Tuesday	—	20 slow/fast 200's
Wednesday	—	1 hour Fartlek
Thursday	—	4 × 600m. with 4 minute recovery
Friday	—	Rest
Saturday	—	Race; or
		a.m. ½ hour steady run
		p.m. 4 × 600m.
Sunday	—	a.m. ½ hour steady run
		p.m. 8 × 300m.

In the above, the Tuesday session involved 20 laps of a 400m. track which was split into two 200m. sections. The first 200m. section was run at about 80% of maximum effort and the second 200m. involved a recovery between 60 and 90 seconds.

FIGURE 2

Schedule February, 1982 in New Zealand:—

31st January a.m. — 13 miles steady
p.m. — 5 miles steady

1st February a.m. — 7 miles steady
p.m. — 5 miles steady

2nd February a.m. — 8 miles steady
p.m. — 8 miles steady

3rd February a.m. — 7 miles steady
p.m. — 7 miles steady

4th February a.m. — 10 miles steady
p.m. — 4 × 1,000m.

5th February a.m. — 5 miles steady
p.m. — 5 miles steady

6th February a.m. — 9 miles steady
p.m. — 5 miles fast

Schedule February, 1982 New Zealand:—

14th February a.m. — 15 miles steady
p.m. — 5 miles steady

15th February a.m. — 7 miles steady
p.m. — 4 × 600, followed by 6 × 150

16th February a.m. — 7 miles steady
p.m. — 10 miles steady

17th February a.m. — 7 miles steady
p.m. — 8 × 300

18th February a.m. — 5 miles steady
p.m. — 12 kilometer road race

19th February a.m. — 8 miles steady
p.m. — 6 miles Fartlek

20th February a.m. — 8 miles steady

April, 1982 Schedule — England

15th April a.m. — 15 miles steady
p.m. — 150, 200, 150

5th April a.m. — 5 miles steady
p.m. — 10 miles steady

6th April a.m. — 6 miles steady
p.m. — 4 × 1,000m., followed by acceleration runs — average time for the 1,000's — 2 mins. 26 secs.

7th April a.m. — 7 miles steady
p.m. — 8 miles steady

8th April	a.m.	7 miles steady
	p.m.	1 × 600m. in 79 secs., followed by 3 × 4 × 150, recoveries 90 secs. and 5 mins., followed by acceleration runs
9th April	a.m.	10 miles steady
	p.m.	5 miles steady
10th April	a.m.	7 miles steady
	p.m.	5 miles steady
11th April	a.m.	7 miles steady
	p.m.	4 × 600m., 5 miles steady
12th April	a.m.	10 miles steady
	p.m.	5 miles steady
13th April	a.m.	7 miles steady
	p.m.	6 × 100m.
14th April	a.m.	5 miles steady
	p.m.	8 miles Fartlek
15th April	a.m.	5 miles fast
	p.m.	8 × 300m.
16th April	a.m.	7 miles steady
	p.m.	9 miles steady
17th April	a.m.	8 miles steady
	p.m.	5 miles steady
18th April	a.m.	15 miles steady
	p.m.	2 × 1000m, 2 × 600m. 6 minute recovery between sessions × 2.28, 2.27, 85 and 83.
19th April	a.m.	7 miles steady
	p.m.	5 × 1,000m.—average time 2.27
20th April	a.m.	5 miles steady
	p.m.	5 × 1,000m.—average time 2.27
21st April	a.m.	7 miles steady
	p.m.	7 miles steady
22nd April	a.m.	5 miles steady
	p.m.	7 miles steady
23rd April	a.m.	5 miles steady
24th April		Race — national Road Relay — **record time of 24 mins. 27 secs., beating the record set by Brendan Foster in 1974.**

FIGURE 3

Final Schedule from June 6th, 1982:—

6th June a.m. — 7 miles steady
p.m. — 150, 200, 150, followed by acceleration runs

7th June a.m. — 7 miles steady
p.m. — 10 miles steady

8th June a.m. — 7 miles steady
p.m. — 5 × 1,000m. in average of 2.27 followed by acceleration runs

9th June a.m. — 10 miles steady
p.m. — 5 miles steady

10th June a.m. — 7 miles steady
p.m. — 7 miles steady

11th June a.m. — 7 miles steady
p.m. — 5 miles steady

12th June a.m. — 4 miles steady
p.m. — 2 miles steady

13th June a.m. — 3,000m. race — won in 7.52 from Waigwa in 7.54

14th June a.m. — 7 miles steady
p.m. — 10 miles steady

15th June a.m. — 7 miles steady
p.m. — no session due to sore leg

16th June a.m. — 7 miles steady
p.m. — 10 miles steady

17th June a.m. — 7 miles steady
p.m. — 7 miles steady

18th June a.m. — 7 miles steady
p.m. — Involved in opening a new track and ran a Paarlauf with a partner — total distance of 6 miles

19th June a.m. — 8 miles steady
p.m. — 8 miles steady

20th June a.m. — 15 miles steady
p.m. — 150, 200, 150

21st June a.m. — 7 miles steady
p.m. — 10 miles steady

22nd June a.m. — 7 miles steady
p.m. — 7 miles Fartlek

23rd June a.m. — 5 miles steady
p.m. — 5 miles steady

25th June a.m. — Flew to Oslo
p.m. — 4 miles steady

26th June a.m. — 3 miles steady
p.m. — The Dream Mile (finishing order — Scott, 3 min. 48.5; Maree, 3 min 48.95; **Moorcroft, 3 min. 49.3;** Walter, 3 min. 49.5; Flinn, 3 min. 50.4), followed by a single 3 mile jog to warm down.

27th June a.m. — 10 miles steady

28th June a.m. — 7 miles steady
p.m. — 10 miles steady

29th June a.m. — 5 miles steady
p.m. — Very windy conditions — 1 x 1,000m. in 2.23 plus 8 × 300m. — all under 40 seconds

30th June a.m. — 7 miles steady

1st July a.m. — 7 miles steady
p.m. — 5 miles fast

2nd July a.m. — 5 miles steady
p.m. — 7 miles steady

3rd July a.m. — 8 miles steady
p.m. — 7 miles fast

4th July a.m. — 14 miles steady
p.m. — 5 miles steady

5ht July a.m. — 5 miles steady
p.m. — 5 miles steady

6th July a.m. — no session
p.m. — 5 miles steady on arrival in Oslo

7th July a.m. — 2-3 miles steady
p.m. — 5,000m. in Oslo **(time 13:00.41 — World Record)**

8th July a.m. — 10 miles steady in Oslo

9th July a.m. — 5 miles steady
p.m. — 5 miles steady

10th July a.m. — 5 miles steady
p.m. — 5 miles steady

11th July a.m. — 12 miles steady
p.m. — 10 × 20/40 acceleration runs plus 2 miles steady

12th July a.m. — 7 miles steady
p.m. — 5 miles steady

13th July a.m. — 5 miles steady
p.m. — 4 × 600m. (average time 83 secs.)

14th July a.m. — 5 miles steady
p.m. — 7 miles steady

15th July a.m. — 5 miles steady
p.m. — 5 miles steady

16th July a.m. — 4 miles steady
p.m. — no session

17th July a.m. — 2 miles steady
p.m. — 3,000m. (Result: **David Moorcroft 1st—7:32.8—European Record;** 2nd Maree: 7 min. 33; 3rd Walker: 7 min. 37. Also ran Scott, Ovett, Wessinghaga).

6.5 10,000m.

Alberto Cova (from Fred Wilt 1985 and quoted from Payne (Ed) 1985).

FACTS AND FIGURES

Alberto Cova was born at Inverigo in the province of Como on December 1st 1958. He is 1.78/5'10" tall, weighs 58kg/128lb, is a member of the Pro Patria Pierrel club of Milan and coached by Giorgio Rondelli. He married Anna Molteni one month after his European 10,000m triumph and they live at Mariano Comense (Como).

Personal bests: 800 — 1:53.2 (1978), 1500 — 3.42.20 (1981), 3000 — 7:15.00 (1980), 5000 — 13:13.71 (1982), 10,000 — 27:41.03 (1982), 3000 SC — 8:37.2 (1980).

Championship record: 1977 — 5th European Junior 5000. 1982 — 2nd European Indoor 3000, 7th World CC, 1st European 10,000 (disq in 5000).

Annual progression at 5000 & 10,000:

1976	(17)	14:38.6	—
1977	(18)	14:04.4	—
1978	(19)	14:07.4	—
1979	(20)	13:58.2	—
1980	(21)	13:40.4	29:20.5
1981	(22)	13:27.20	28:29.12
1982	(23)	13:13.71	27:41.03

Alberto Cova's Training

Early-winter training is continuous running on surfaces away from the track, including hills. Except for Sundays, he trains twice daily. Here is a typical week of daily running volume during this period:

Sunday and *Monday* - 25 km at 3: 45-4: 00 per km
Tuesday and *Friday* - 20 km at 3: 45-4: 00 per km
Wednesday - 16km at 3: 45-4: 00 per km
Thursday - 30km at 3: 45-4: 00 per km
Saturday - 8km at 3: 20 per km, followed by 4 km at 3: 10 per km

Training during winter competition includes the following types of workouts which are included in the total volume of 170-180 km running per week:

a) 16-20 km continuous running at 3: 20-3: 30 per km over hilly terrain.
b) 15-20 × 300m in 48-50 sec, with 100m recovery jogging 30-40 sec after each.
c) 15-20 × 400m in 64-66 sec, with 200m recovery jogging in 50 sec after each.
d) 10 × 1200m in 3: 30-3: 35, with 400m recovery jogging in 90 sec after each.

Typical training prior to major competition during summer takes the following form:

Monday - 20-30 km continuously at 3: 10 per km
Tuesday, *Thursday*, *Friday* and *Sunday* - 20-30 km continuously at 4: 00 per km
Wednesday - 25 × 400m in 62-64 sec, with 200m recovery jogging in 50 sec after each
Saturday - 5 × 2000m in 5: 30, with 800m recovery jogging in 3: 15 after each
Alternate Tuesday workout - 4 × 500m in 61-62 sec. 5 × 300m in 45 sec. 10 × 200m in 28 sec. Jog 100m recovery after each
Alternate Thursday workout - 6 × 1000m in 2: 35, with 1000m jogging in 4-5 minutes after each
Alternate Sunday workout - morning: 8 km continuously at 3: 15 per km. Afternoon: 12 × 300m in 44-46 sec, with 100m recovery jogging in 30sec after each.

6.6 Marathon.

Robert de Castella (from Fred Wilt 1985 and quoted from Payne (Ed) 1985).

Francois Robert de Castella is of French-Swiss ancestry and was born on 27 February 1957 in Melbourne, Australia, the eldest of seven children. He is a graduate of Xavier College and Swinburne College in Melbourne. He is 1.80m (5ft 10ins) tall, weighs 65 kg (143lbs) and has a maximum oxygen uptake of 85 ml per kg of bodyweight per minute. De Castella is employed as a biophysicist in the Sportsmedicine Department of the Australian Institute of Sports and is married to former Australian cross-country champion Gayelene Clews.

Regarded as one of the world's premier Marathon runners, de Castella's best marks are: 400m (57.0 in 1980); 800m (1:57 in 1975); 1500m (3:49 in 1981); 3000m (8:04.6 in 1979); 5000m (13:34.28 in 1981); 10,000m (28:12.2); 15 km (road) (42:47 in 1983); half-Marathon (1:01:18 in 1982); and Marathon (2:08:18 in 1981).

Robert de Castella's Training

Typical workouts at age 15 to 17 years:

Sunday - 20-23 km (12-14 miles) continuous cross-country run in the Ferny Creek area of the Dandenong mountains, outside Melbourne

Monday - 10 km (6¼ miles) relaxed continuous cross-country run

Tuesday - 5 km (3 miles) continuously over a course consisting of 6-8 hills, each covering a distance of 180m, followed by 250m of recovery run-

ning after each series of hills
Wednesday - 16 km (10 miles) relaxed continuous running
Thursday - 11 km (7 miles) continuous relaxed run, or 6-8 × 200m very fast on the track, each followed by 200m of recovery jogging
Friday - rest
Saturday - race each week, except January and February during very hot summer weather

De Castella's total average weekly mileage during this period was approximately 60-80 km (40-50 miles).

Typical training since 1979:

Sunday - morning: 29-34 km (17-22 miles) continuous run in 2:15-2:20. Afternoon: 8 km (5 miles) easy continuous run.
Monday through *Friday* at 8.00am to 9.00am - 8-10km (5-6 miles) at a reasonably rapid continuous pace, but never at a 'long slow distance' speed
Monday afternoon - 17km (10 miles) continuous relaxed run
Tuesday afternoon - 20km (12 miles) continuous run, including 5km (3 miles) of hilly terrain. Alternate Tuesday workout: 12 laps on a 400m track, running strongly for 100m on each straight and running 100m more slowly and relaxed on the curve after each fast surge on the straight
Wednesday afternoon - 25-30km (15-18 miles) continuous relaxed run in 1:55-2:00 hours
Thursday afternoon - Track session. 5km (3 miles) warmup, followed by 8 × 400m in 63sec each, with 200m of recovery jogging after each, or 8 × 200m at near full speed, with 200m recovery jogging after each
Friday afternoon - 16km (10 miles) continuous relaxed run
Saturday - race or sustained long run of 32km (20 miles) or longer. Average weekly mileage: 185km (110 miles).

'Deek', as he is known to close associates, does no weight training. He and his only coach, Pat Clohessy, scorn the use of 'long slow distance' distance running. They emphasize that all de Castella's continuous runs are performed at a reasonably speedy but not exhausting effort. He does very little stretching as a part of his training routine. His workouts are basically the same throughout the year, in as much as Coach Clohessy does not believe in traditional 'peaking' for a particular race. The intervals he runs on the track are never longer than 400m and never more than eight in number. His 'relaxed' running in terms of speed is 6:15 to 6:20 per mile.

One variation in de Castella's workouts comes approximately five weeks before a Marathon when he runs 30 miles continuously in about 3:20:00. Much of his training today takes place in the Stromlo Forest, near Canberra.

Chapter 7

Conclusions.

I believe that by and large of the objectives of the dissertation have been achieved. It has provided the Author with a greater insight into the planning of the training programme particulary in respect of the training unit components and the nature of micro and macrocycles.

Possibly Chapters 2 and 5 make the most significant contributions to this work.

However the question might arise of the inter-relationship between Chapters 6 and 7. Chapter 6 represents the ideal theoretical model whilst Chapter 7 illustrates the elite athlete in practice. Is there a congruance between the two ? Much will depend upon the ability of the athlete, their objectives, what facilities are available and whether there is coaching expertise available from which to draw.

Inevitably the Author is left with the feeling that certain sections of the dissertation could be improved upon. Perhaps Chapter 5 (The Planning of the Training Programme) could be expanded upon and more examples of training given within the different microcycles, how they progress in terms of intensity and/or volume and what alternate training sessions might be used.

In Chapter 4 perhaps a better explanation could be provided between Figure 9 (Page 35) and the overview of the endurance training methods provided in Figure 12 (Page 47).

It may be that the Author should now develop each Chapter in turn, use less 'academic' language and submit them for publication in such journals as Athletics Coach, Track Technique or Modern Athlete and Coach. This could act as a prelude prior to giving consideration to a formal publication.

Clearly many of the ideas of the Author on the subject of endurance running have been drawn together in this publication and the first hurdle toward such a publication has been overcome.

Chapter 8

Bibliography.

1. Athletics Coach (1984): Technical Olympic Report, Los Angeles 1984; Vol 18 No 4 December 1984 (British Amateur Athletic Board).

2. Alford J.W. (Editor)(1983): Running - The IAAF Symposium on Middle and Long Distance Events (International Amateur Athletic Federation, London).

3. British Amateur Athletic Board (1980): Technical Olympic Report, Moscow 1980 (B.A.A.B.)

4. Bicourt J. (1983): 'Interview with Alberto Cova' - Athletics Weekly Vol 37 No 8.

5. Bompa T.O. (1983): Theory and Methodology of Training (Kendal/ Hunt Publishing Co. Iowa).

6. Brook N. (1987): Endurance Running (The Crowood Press, Marlborough U.K.)

7. Brook N. (1984): 'Current Trends in Endurance Training' - Athletics Coach Vol 18 No 2 (British Amateur Athletic Board).

8. Costill D.L. (1979): A Scientific Approach to Distance Running (Tafnews, Los Altos U.S.A.)

9. Dick F.W. (1980): Sports Training Principles (Lepus Books, London).

10. Dick F.W. (1984): Training Theory (British Amateur Athletic Board).

11. Doherty J.K. (1964): Modern Training for Running (Prentice Hall Inc. New Jersey U.S.A.)

12. Fox E.L. and Mathews D.K. (1981): The Physiological Basis of Physical Education and Athletics (CBS College Publishing, Philadelphia U.S.A.)

13. Humphreys J. and Holman R. (1985): Focus on Middle Distance Running (Adam and Charles Black, London).

14. Humphreys J. and Holman R. (1983): Focus on the Marathon (EP Publishing Ltd. Wakefield, U.K.)

15. Jarver J. (Editor)(1983): Middle Distances (Tafnews, Los Altos U.S.A.)

16. Johnson C.J. (Editor)(1985): Senior Coaching Award - Coaching Theory Manual (British Amateur Athletic Board).

17. Kernan J. (1978):'How They Train - Henry Marsh' - Track Techniq No 73 Fall 1978.

18. Newsholme E. and Leech T. (1984): The Runner (Fitness Books, Oxford).

19. Payne H. (Editor)(1985): Athletes in Action (re Fred Wilt on Long Distance)(Pelham Books, London).

20. Pyke F.S. and Watson G.G. (Editors)(1978): Focus on Running (Pelham Books, London).

21. Rowland M. (1978): 'Garderud's Training for the 1976 Olympics' - Athletics Weekly Vol 32 No 52.

22. Schmolinsky G. (Editor)(1978): Track and Field (Sportverlag, Berlin).

23. Scottish Amateur Athletic Joint Coaching Committee (1976): Montreal 1976 Technical Report.

24. Tanner J.M. (1964): The Physique of the Olympic Athlete (George Allen and Unwin Ltd. London).

25. Track Technique (TT) Staff (1976): 'How John Walker Trains' - Athletics Weekly Vol 30 No 30.

26. Watman M. (1987): 'World Marathon - Main Contenders' - Athletics Weekly Vol 41 No 19.

27. Watts D.C.V. and Wilson H. (1973): Middle and Long Distance, Marathon and Steeplechase (British Amateur Athletic Board).

28. Wilt F. (Editor)(1976): 'How They Train - John Walker' - Track Technique No 64 June 1976.