Jorge Diaz Gamboa is a professor of Physical Education and a national coach, specialising in the sprints and middle distances. He is the coach of P. Squella, who holds the national record of Chile for the 800 and the 1500 metres.

Ray Elrick is a coach with the Ottawa Lions and has one of the largest training groups for the middle distances in Canada.

Amarilis Hernández Mora is the national athletics team coach for Cuba.

Dr David E. Martin is Regent Professor of Physiology at the Georgia State University, Atlanta, USA. He has co-authored a book entitled 'Training Distance Runners'. His work includes long-term physiological testing of elite athlete performance.

Manuel Pascua Piqueras is Spanish national coach for the middle distance events. Among the many top class athletes he has coached are A. Paez and T. de Teresa.

In the 1980's Matt Paterson was Steve Ovett's regular training partner. He now lives in Australia, where he is a high performance coach for Athletics Australia.

Paul Schmidt was formerly head coach for the German national men's team and national coach for 800 metres until he retired end of 1996. One of his top-class athletes was the 1983 800m world champion Willi Wübbeck.

Carlo Vittori is a Technical and Scientific Committee member of the Italian athletics federation FIDAL. He is a former national sprint coach for Italy and also former personal coach of P. Mennea.

1. The times of the world's two best ever performances in the 800 metres indicate the importance of exceptional 400 metres speed for real success in this event. Yet, the majority of the top 800 metres runners have shown exceptional ability in the 1500 metres rather than the 400 metres. How do you reconcile these two facts?

DIAZ GAMBOA:

The fact that top level 800 metre runners can run between 45 and 46sec for the 400 metres means that they possess a basic sustainable speed of about 8.6 to 8.8m/sec, which is equivalent to an anaerobic capacity of 75%. In the 800 metres, however, the average speed achieved is 7.86m/sec and the ratio is 35% aerobic and 65% anaerobic. This significant difference between the two average speeds (1m/sec) makes the 1500 metres, with an average speed of 7m/sec and a balanced distribution of the aerobic and anaerobic requirements of about 48-49%, a more comfortable event. Therefore, I believe that the ability of 800 metre runners to produce better performances at the 1500 metres is due to this race requiring an average speed of only 79.5% of their basic sustainable speed. Moreover, its anaerobic demand is 20% less than that required for the 400 metres, thus resulting in a more comfortable run and the possibility of achieving the fastest possible last 300 metres.

ELRICK:

There have been a few 400/800 types who have been successful 800 metre runners, but I dare say that these individuals would have had some success at 1000 metres and perhaps even at 1500 metres. 800 metres running is about endurance and speed together, not just flat out 400 metres speed. Indeed, world class 800/1500 metres runners must have excellent 400 metres speed, e.g. 46-48 sec, to succeed. They also require the endurance to train at the levels needed to be successful.
1. The times of the world’s two best ever performances in the 800 metres indicate the importance of exceptional 400 metres speed for real success in this event. Yet, the majority of the top 800 metres runners have shown exceptional ability in the 1500 metres rather than the 400 metres. How do you reconcile these two facts?

Today, there appears to be a trend towards specialisation. Very few of the top 1500 metres athletes compete at the 800 metres. Perhaps, the prize money on the circuit has a lot to do with this. Nevertheless, the theory that the 400 metres types would take over the 800 has not been confirmed. One still requires endurance to go along with speed to be successful at the 800 metres.

HERNÁNDEZ MORA:
The experience we have had in Cuba in this respect shows us that the athletes who have moved up from running 400m have had corresponding results over 800m. It should be taken into account that the current split times for the 800m require a good pace over the first 400m, and to illustrate this we have the example of Alberto Juantorena Danger, Norberto Tellez and Ana Fidelia Quirot. There are, however, other athletes in the world who train for 1500m and also have good results over 800m.

MARTIN:
The 1500 metres event has a very substantial aerobic component, with a steadily increasing anaerobic component, particularly during the final lap. As will be seen in the discussion of Question 2 (below), the 800 metres event also has a sizable aerobic element, though smaller than the 1500 metres. In contrast, the 400 metres event is very nearly all-out, and thus quite anaerobic in its nature, with only a small (initial) aerobic component. Experts at both 800 metres and 1500 metres do substantial amounts of both aerobic and anaerobic training, whereas 400 metres runners focus more specifically on anaerobic work. Thus, the 800 metres "specialists" tend to race over 1500 metres rather than over 400 metres (the 1500 metres race "feels" like a "sub-max" effort, implying less anaerobic stress, and thus builds the endurance component of middle-distance racing). So also, the 1500 metres "specialists" often prefer 800 metres races to 3000 metres, with the aim of building up strength and power that will make their slower-paced 1500 metres race "feel" easier.

PASCUA PIQUERAS:
The 800 metres race always demands a mixture of aerobic and anaerobic energy; basic speed plays a fundamental role. There have always been athletes who have come down from the 1500 metres and others who are specifically 800 metre specialists, with a predominance of speed, such as Juantorena and Fiasconaro, but always also with an aerobic base, which allowed them to face up to the second half of the race. I do not believe that the top performers in the 800 metres owe their predominance to great underdistance speed (this could be said only of Sepeng and Tellez), since Kipketer and Rodal possibly possess much less basic speed than Coe, Cruz and Juantorena. I believe that what characterizes the middle distance races today is intense specialisation, motivated by the fierce competition encountered in every race. Athletes must concentrate on what provides them with the most success, train with a single objective and cultivate their stronger qualities. If I had to state the acid test for defining an 800 metres specialist, I would be inclined to choose the 1000 metres, with the proviso that only those capable of a time better than 2:14 would have any chance of attacking the world record. On the other hand, I do not believe that a time of 3:30min for the 1500 metres would guarantee better than 1:42 for the 800. In fact, Aouila, Morcelli and Niyongabo have run the 800m at a certain level, but far below the times that characterize the event today. In conclusion, aerobic training must not conflict with training for speed, or, more exactly, the preparation of the specific speed for the event.
The times of the world's two best ever performances in the 800 metres indicate the importance of exceptional 400 metres speed for real success in this event. Yet, the majority of the top 800 metres runners have shown exceptional ability in the 1500 metres rather than the 400 metres. How do you reconcile these two facts?

**Paterson:**

In his article "Solving the 800m puzzle", F. J. Horwill (In: Modern Athlete and Coach, Adelaide, vol. 343, no. 4, October 1996) states that there are three categories of 800m runners:

1) Those with superior speed over 400 metres, in the range from 44-46sec, who race mainly 400 and 800 metres. Tall, well-built athletes, who train around 45km a week, with mostly high quality work, like Alberto Juantorena, Vebjorn Rodal, Paul Ereng and Thomas Courtney, all Olympic gold medallists, fall into this category.

2) Those possessing good speed at 400 metres, in the range from 46 to 48sec, who race mainly 800 metres but have good 1500 metres performances. They tend to weigh less than those in the first group and run about 90km a week, with high quality work at 1500 and 800m speeds. Sebastian Coe, Joaquim Cruz, William Tanui and Mike Bolt would fall into this category.

3) Those possessing moderate 400 metres speed from 48-50sec, who race mainly 1500 metres and take part in the 800 metres races to add speed to their main event. This group tends to be ectomorphic in build and run about 135km a week. Steve Cram, Steve Ovett and Peter Elliott would fall into this category.

The art of 800 metres running is to maintain near top speed for as long as possible. As there appear to be three main categories for the running of this event the training must be specific to whatever the athlete has at his disposal in the way of basic speed. If the athlete is in category 3, then there would be little purpose in his training at near top speed throughout the year, as his body would find it hard to cope with this very intensive work. As Peter Elliott says "it is not necessary to be able to run a 200 metres in 21 seconds. It is more important to be strong over the last 200 metres of the race." How often is the last 200 metres of a major 800 metres race the fastest 200m split of the race? It is usually the slowest!

The work carried out by A. V. Hill in 1932 suggested that the 800 metres is 67% anaerobic and 33% aerobic. However, Hill's research took place over sixty years ago; the latest research tends to show that the aerobic contribution during a short duration exhaustive exercise is much greater, i.e. the aerobic contribution of a 400 metres sprint is more likely to be 45-50% of the total energy supply. If this theory is proved to be correct then it will explain why so many top class 800 metres runners have shown exceptional ability over 1500 metres rather than 400 metres. The energy systems of the 800/1500 metres would appear to be closer than that of the 400/800 metres.

A top class 800m runner should have a fair amount of speed over 400 metres; some can also run a good 1500 metres, when necessary. As there is not one formula for producing top 800 metres runners, it makes the event all the more intriguing, when trying to come up with the correct ingredients in the formulation of a training programme.

**Schmidt:**

There is no argument that, to achieve exceptional performances in the 800 metres, a runner must be capable also of excellent results in the 400 metres. This is accepted by middle-distance coaches all over the world and they agree with a minimum performance of under 47.0sec as being necessary to run times of 1:45min or faster. I do not know of any published research suggesting that the majority of the present 800 metre runners come from the 1500 metres. I rather think that the top Kenyan runners, as well as the American ones and many from other countries, are excellent 400 metre runners, being able to run 46.0sec or better, and this is a great asset for the 800 metres. Naturally there is
1. The times of the world's two best ever performances in the 800 metres indicate the importance of exceptional 400 metres speed for real success in this event. Yet, the majority of the top 800 metres runners have shown exceptional ability in the 1500 metres rather than the 400 metres. How do you reconcile these two facts?

2. In your view, what is the ratio of anaerobic to aerobic energy expenditure in a World Record 800 metres and what significance would this have on the training for this event?

Díaz Gamboa:
The anaerobic/aerobic ratio in the 800 metres world record is associated with a running speed of 7.86m/sec, which will determine an energy distribution of 35% aerobic and 65% anaerobic. Of the anaerobic proportion, 25% will be alactic and 45% lactic acid. This analysis reveals the need to emphasise strongly the development of the anaerobic lactic system in the training of these runners.

Elrick:
The ratio of anaerobic to aerobic energy expenditure is roughly 45% to 55%. The aerobic work required would range between 80 and 100% of an athlete's VO2 max. The anaerobic work would range between 200 metres speed and 1500 metres speed. Of course, along with these workloads would be flat-out sprints of up to 8 seconds.

Hernández Mora:
A world record is predominantly anaerobic; the best results are obtained with an anaerobic capacity. In the training for this event, one should concentrate on anaerobic work, so that in carrying out this kind of work, the athlete develops better racing skills.

Martin:
Graphs have been published frequently which show the relative aerobic and anaerobic energy contributions for racing over distances ranging from 100m to the marathon. Taking an average of several of these published graphs gives a ratio of aerobic/anaerobic contributions for the 800 metres as 57% : 43%. Such a ratio tends to be misleading, because the nature of the race changes from start to finish. The first 400 metres will be run substantially more aerobically than the second 400 metres, because the athletes, at the beginning, are still fresh, and are running at around 95% to 96% of their personal best for 400 metres. It is not unlikely that the first 400 metres is raced using an aerobic/anaerobic ratio of about 65:35%. The second 400 metres will likely be run slightly more slowly than the first and, therefore, at a lower percentage of the athlete's personal best for 400 metres. However, this lap will begin with the athlete already experiencing substantially more tissue acidosis than when starting a single 400 metres run. This final 400 metres will demand an ability to tolerate an ever-increasing acidosis on top of this.
2. In your view, what is the ratio of anaerobic to aerobic energy expenditure in a world record 800 metres and what significance would this have on the training for this event?

A reasonable estimate of the aerobic/anaerobic energy requirement for this second lap might be 35% : 65%. Thus, in biochemical or physiological terms, the two laps are really quite different. Training for the 800 metres event, therefore, should include both kinds of work: hi-end aerobic work in the face of developing acidosis, and high-end near maximum anaerobic work.

PASCUA PIQUERAS:
The energy expenditure for the world record 800 metres has been estimated as 167.4ml/kg (ARCELLI) and it has also been calculated that the anaerobic work (lactic + alactic) represents not more than 35% of the total (65% aerobic). Nevertheless, we know that as the time for the event is reduced, so the aerobic component is also reduced and the anaerobic element increased. Evidently, for any future attack on the 1:40min barrier (1st lap 49sec, 2nd lap less than 50sec, which is by no means Utopian), anaerobic training and the development of specific speed will become more important, but never forgetting the aerobic base. I do not believe that the present records are due to any change in the system of training, but merely a consequence of a more specific dedication to the event.

PATERSON:
The ratio of anaerobic:aerobic energy expenditure in a world record 800 metres would, in my opinion, be somewhere around 60:40. Depending on what category the athlete falls into, training should be adjusted accordingly. Athletes who fall into category 1 would benefit much more from doing work which involves the anaerobic energy supply and lactate tolerance system, without entirely neglecting the aerobic system. The percentage of which system is used depends on the coach and the individual athlete.

SCHMIDT:
Several scientific researches deal with energy expenditure in 800 metre races, i.e. the ratio of aerobic to anaerobic energy. All the research with which I am acquainted states that, in world-class races leading to the very top performances, the anaerobic energy expenditure is definitely above 50%.

Regarding training, it must again be pointed out that there are certain individual differences, arising from the types of runners and their metabolic function. The distribution of effort due to tactical considerations is also an important factor. A major consideration for training is the necessity for a very high proportion of competition-specific loads, depending on the period of the year. I would like to take, as an example, the competition period, during which it is essential to have up to three, or even four, sessions with high competition-specific loads in the weeks where there are no races. Here the anaerobic energy supply is built up, so that the athlete develops the ability to run with a high oxygen debt – which he is forced to incur, at least in the second half of a race, and still finish an 800 metres race strongly.

VITTORI:
I agree with those authors (Foss, BOWERS and others), who suggest that the proportions of 65% and 35%, for anaerobic and aerobic energy respectively, are required for world class results. In any case, if the 800 metre runner needs to be capable of 45sec in the 400 metres and 21sec in the 200 metres, this proportion would seem to me to be reasonable. Naturally, this means that a training programme should be based around this balance between the two components of this energy mix, in order to favour the development and the improvement of the capacities
which enable such performances to be achieved over these shorter distances. Training should centre on improving speed/endurance, lactic resistance, strength and speed.

3. How would you structure the strength training programme for the development of speed in the 800 metres?

DíAZ GAMBOA:
I would recommend working on the following lines:

a) Weight training

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Sets</th>
<th>Repetitions</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half Squats</td>
<td>3-4</td>
<td>12-15</td>
<td>60% of body weight</td>
</tr>
<tr>
<td>Full Squats</td>
<td>3-4</td>
<td>12</td>
<td>40% of body weight</td>
</tr>
<tr>
<td>1/4 Squat bounces</td>
<td>3-4</td>
<td>20-30</td>
<td>40% of body weight</td>
</tr>
<tr>
<td>Press from 45°</td>
<td>3</td>
<td>15</td>
<td>60% of body weight</td>
</tr>
<tr>
<td>Quad Stretch</td>
<td>3-4</td>
<td>20</td>
<td>25% of body weight</td>
</tr>
</tbody>
</table>

b) Multi jumps

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Sets</th>
<th>Repetitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hops</td>
<td>3-4</td>
<td>25-30</td>
</tr>
<tr>
<td>2 legged hops (Bunny hops)</td>
<td>3-4</td>
<td>40-50</td>
</tr>
<tr>
<td>Rebounds on the toes</td>
<td>3-4</td>
<td>60</td>
</tr>
<tr>
<td>Hurdle jumps</td>
<td>1-2</td>
<td>50-60 [10x(5-6h)] at .76cm</td>
</tr>
<tr>
<td>Running up steps</td>
<td>2</td>
<td>10 runs (15-20 steps)</td>
</tr>
<tr>
<td>Running down steps</td>
<td>3</td>
<td>8 runs (10-15 steps)</td>
</tr>
</tbody>
</table>

I recommend that the basic period should include 2 sessions of weight training to one of multi jumps. In the specific training period this should be changed to 2 sessions of multi jumps and one of weight training and the pre-competition period should include at least one session of each or two of multi-jumps.

ELRICK:
Successful 800 metre runners do more than just run when developing their expertise. They must work the muscle groups that are not specifically challenged by running. A strength programme will improve the functional capabilities of ligaments, tendons, cartilage as well as working muscles. Improved strength improves quickness and safety, with submaximal workloads being more easily tolerated. Our programme uses a variety of equipment and techniques. Beginning in November we gradually increase the intensity of load applied. As adaptation occurs the size of the stimulus is increased. We continue this pattern until we reach our hardest sessions during March/April. From then until the beginning of the competition season, we encourage the athlete to alternate between a light weights session and an easy circuit session. The key to the programme is progression.

HERNÁNDEZ MORA:
This type of work should be done 2 or 3 times a week, on alternate days, according to the stage of the season.

MARTIN:
The strength component for 800 metres racing requires 1) an on-going year-long programme in the weights room - using free weights to build total-body strength and power, and 2) practical implementation of the strength and power gained by such development, using appropriate kinds of running. The best single track activity for applying such work to the 800 metres is training to improve the ability to manage fast, repeatable 400m intervals. The weights room work increases skeletal muscle protein, augments the storage of muscle fuel and fuel-using
3. How would you structure the strength training programme for the development of speed in the 800 metres?

enzymes, and improves neuromuscular recruitment in the muscles of the legs, back, shoulders, arms and abdomen. This increased strength and power permits tolerance to heavier and heavier loads. Transferring this to track running, the faster and still faster running intervals as the year goes on (with shorter and still shorter recovery times between intervals) improves high-speed stride mechanics. Successful training, over time, makes slower-paced 800 metres racing now "seem" easy. Thus, ever-faster running speeds can be attempted and faster race times will result.

PASCUA PIQUERAS:
Strength is acquiring a fundamental importance in 800 metres training, due to the specific work carried out for the development of greater speed. Strength training appears, more and more, to resemble the work carried out by the 400 metre runners, rather than that done by the middle distance athletes. In my opinion, strength training for these athletes should be carried out on the following lines: 2-3 sessions per week, using weights and systems similar to those of the sprinters, basically using exercises aimed at augmenting elastic strength, more use of isometric work (including exercises of long [several minutes] duration, strengthening of the plantar, soleo-gemellus, biceps femoral and gluteus muscles. Very important are exercises with light weights or without weights, horizontal and vertical multi-jumps, harness runs, plyometrics, runs with weighted belts and hill runs (short and long). I would say that strength training for the 800 metre runner of the future is just as important as basic aerobic and lactic work. Speed will come from strength.

PATERSON:
The strength training programme for the development of speed in the 800 metres should include work to develop most types of strength. A well-planned concentration of speed-strength exercises, at specified stages in a training year, allows 800 metre runners to reach a high level of speed-strength at the time of their major competitions. This gives them the ability to surge during a race and to accelerate in the finishing stages. Strength endurance is important to offset fatigue in anaerobic strength performances and to improve the anaerobic energy supply and lactate tolerance. The plyometric method of depth jumps and bounding and jumping exercises, as used by Coe in his training, will develop reactive strength. This type of training improves inter and intra muscular innervation. Explosive strength work can effectively improve the athlete's acceleration and speed. Training for maximum strength is also important, but I would tend to use it sparingly, because of the risk of injuries which this sort of work entails.

The allocation of strength training loads could be distributed as follows:

a) Preparation phase (4 months) 20%.
b) Second preparation phase (4 months) 30%.
c) Specific preparation phase (2 months) 10%.
d) Competition phase (2 months) 5%.

SCHMIDT:
To achieve top class performances in the 800 metres, distance-specific strength training, i.e. strength training related specifically to the 800 metres, is essential. I would like to give just a few examples. Taking into account the age of the athlete and the level of performance already reached, it is obviously profitable to build up an overall athletic fitness with adequate training and strengthening exercises, using the resistance of the runner's own body-weight and also dumbbells or weight machines. In this way, specific strength endurance can be developed, again in relation to the particular training period. This can be further
3. How would you structure the strength training programme for the development of speed in the 800 metres?

**VITTORI:**

The development of strength will involve both the anti-gravitational and flexor musculature of the lower limbs (feet, legs, thighs, hips). One must concentrate on increasing the development of "speed strength", of the ability to produce ever greater power in ever shorter times. The expressions of strength which must be stimulated are those of "explosive strength" and "reactive strength".

This development must be both generalized and specific.

- **Exercises of a general nature:** Fast, rhythmic half squats (maximum weight equal to twice body weight) in a set of repetitions; lunges with jumps; in repeated sets, with loads of between 50% and 100% of body weight.

- **Specific exercises:** Bounds on alternate feet over distances of 50/100m, with and without a weighted belt (with weights of 10/15% of body weight); uphill sprints on a 15% gradient over a distance of 50/60m, with adequate rest periods in between; skipping, with and without ankle weights (2kg), for 300 fast contacts, timed.

During a first two-month period, general strength work should be carried out. In a second two-month period, general work will be complemented by specific work and in a third period of two months only specific work will be carried out.

4. Peter Coe has argued that, whatever the stage of training, the 800 metres runner must never lose sight of speed. How would you structure the training programme to comply with this concept?

**DÍAZ GAMBOA:**

It must be recognised that speed is a neuromuscular quality, the development of which must never be neglected. Therefore, the preparatory period must include, at least once a week, specific work on speed, preferably on Wednesdays. In the pre-competitive period this should be increased to twice a week, preferably on Tuesdays and Fridays.

**ELRICK:**

Speed training should continue throughout the year, with the only change being that of the variation in emphasis. Our training environment is limited. The harsh winters do not allow for outdoor speed work and we do not have an indoor track. However, we do train for speed. Sprint drills and accelerations provide the needed stimulus. In addition, at any indoor competitions we attend, middle distance athletes are required to run in the 4x200 or 4x400 relays.

**HERNÁNDEZ MORA:**

Taking into account that the 800m runner must have an optimal split time during the race, it is necessary to develop this ability, so that, in a micro-cycle of 10 sessions, this ability should be worked at 4 or 5 times, on alternate days, depending on the stage of the season.

**MARTIN:**

The idea of preserving a speed capability throughout the year makes physiological sense. Remember that fast-twitch muscle cells are essentially inactive at paces slower than moderately fast. Therefore, long blocks of training without faster-paced work will promote detraining of the very muscle fibres that will make the difference between winning
4. Peter Coe has argued that, whatever the stage of training, the 800 metres runner must never lose sight of speed. How would you structure the training programme to comply with this concept?

and losing the race. Also, one should realise that hard training (weight training, volume loading), during the initial several months of a macrocycle, will leave an athlete chronically fatigued on a day-to-day basis. The mentality for performing at high speed on the track will be poorly developed, because the peak racing season is months away. Thus, although the effort at which speed work is carried out may be fairly similar over the duration of a season, the actual pace attained may vary substantially, due to background fatigue from other training, as well as the limiting factor of the level of strength and power attained.

Pascua Piqueras:
I am in complete agreement with Peter Coe on the need to keep up speed throughout the year. But I would say further that one can augment speed in the general and special period of training but not in the specific period, which should be dedicated to specific running work, and not to strength or speed. The 800 metre runner should concentrate on training for speed/strength just from November to April. These months should include sessions of strength and speed work similar to those performed by sprinters, in order to augment those two basic qualities. However, the period from May to October should be used to learn how to utilise this velocity base to support a high cruising speed and a good finishing burst.

Paterson:
The 800 metres runner must never lose sight of speed. I would agree with this statement, as long as one takes account of what is actually meant by speed. Does Peter Coe mean racing speed or does he mean sheer speed? It must be remembered also that the track season is becoming longer and more intensive. Top class athletes, therefore, must be able to cope with running in many meetings throughout the world, and always close to their best. To do this, the athletes' preparation phase must be sound enough to enable them to last out the season and to carry on without the hindrance of injury.

If I look at the British/Norwegian athletes and how they train in the winter months, my own experience of living and working in both countries shows that athletes adapt to the tough winters and that this can sometimes be an advantage, in that it may strengthen their psychological make-up. Nowadays many of these athletes will travel abroad in the winter months, in order to train in warmer climates.

Seb Coe would train many winters in the tough terrain of Yorkshire, building up that strength in his legs that would enable him to run fast when the track season came along. Peter Elliott, Steve Cram and Steve Ovett were three World class 800 metres runners, who were also excellent cross country runners. Cross-country races, during the preparation phase, served to break up the monotony of hard winter training.

In Norway there are indoor halls or stadiums, where the athletes can do some good conditioning work in the winter months, when outside temperatures can be around -15°C for three to four months. The structure of the training programme, in relation to speed, depends on the climate of the country. It would be impossible to do fast repetitions in Britain in the middle of winter without risking injury. It is possible, during this period, to carry out sessions of 10x400m in 61sec with 1min recovery, or 6x800 in 2:05 with 3min recovery. For some athletes these would be very tough sessions any time of the year. This is the type of conditioning work some of the top British 800 metres runners would use in the winter. To try to run sessions such as 5x300m in 38.0sec with a 3min recovery would be very difficult in the winter months but not impossible in the spring. To obtain the correct balance, in relation to the various components of speed, strength, endurance and technique, is the
4. Peter Coe has argued that, whatever the stage of training, the 800 metres runner must never lose sight of speed. How would you structure the training programme to comply with this concept?

SCHMIDT:
I agree with Peter Coe that the development and maintenance of speed have to be considered throughout the yearly training period. Again, one must pay attention to the individual abilities of the runner and the actual training period. A recommended form of training is the ABC of sprinting (Sprint-ABC), modified in respect to 800/1500 metre running. This involves short sprints with long breaks (quite often the breaks are considered too short!). Attention must be paid to a correct running technique and it should be kept in mind that, in the actual race, the runner must be able to ignore the 'pain' of intense fatigue and still surge into a sprint for the finish. However, because of a lack of time, the 800 metre runner will seldom be able to spend a complete session on speed training. Therefore, it is useful to employ a combination of sprint training with subsequent exercises of either competition-specific or extensive character.

VITTORI:
I believe that this has been largely dealt with in the preceding answer, in that fast strength training, comprising a number of dynamic exercises, facilitates the development of those basics of strength essential for the development and maintenance of qualities of speed. Naturally the schedule described above should be carried out in conjunction with special training, consisting of running exercises over distances of between 60 and 150 metres and at gradually increasing speeds, as the athlete's ability improves.

5. What sort of drills would you use for the development of speed for the 800 metres runner?

DIAZ GAMBOA:
I would use the following:

a) Harness runs; 10 repetitions, pulling loads of 25-30kg, over distances of 100 to 250m: or series such as 3-4 x 100m + 3-4 x 150m + 3-4 x 200m.

b) Varied speed runs, 50m fast/50m slow, over total distances of 1000 to 3000m. For example, 3 laps of 50m fast/50m slow, with a recovery pause of a 400m jog for every 3 laps.

c) 3 x 1000m runs, 50m fast, 50m slow with pauses of a 300m jog between each run.

ELRICK:
We use a variety of sprint drills, strength endurance exercises, dynamic flexibility and acceleration runs. Sprint drills include: high knee running and marching; bounding with fast cadence and into strides; hops and jumps both single and double leg. Endurance exercises include high knee runs over increasing distances, half-squats in increasing numbers and sets, dynamic flexibility drills for increasing strength and joint mobility and fast accelerations for the proper stimulus. Again, the key is progression.

HERNÁNDEZ MORA:
In the preparation period, various reactivity exercises should be carried out in different positions:

- Starts in different positions over 20 to 30 metres.
- Reactivity exercises and various jumping and bounding activities.
- Pre-season – time trials for pure speed, relative speed and power.
MARTIN:
Hill-running drills are very useful. One type involves speed sessions up a short, steep hill, and another involves slower-paced runs up a longer, more manageable hill. Both require exaggerated running mechanics, particularly with regard to knee lift and the use of arms and shoulders. This improves the mechanics for level-paced faster running.

A second facet of development includes over-distance change-of-pace running, with the aim of acquiring an excellent sense of pace and building up tolerance to the discomfort of the variations of pace that are so often a part of the 800 metres race. Drills can include several one-minute-faster, one-minute-slower elements during an over-distance training run.

A third kind of training involves speed drills to build raw strength, power and neuromuscular co-ordination. One example involves sprint intervals of 30 to 40 metres on the straight, using a standing start which begins about three steps back from the start line.

PASCUA PIQUERAS:
Of prime importance is the mastery of the technique of running, supported by the muscular balance of the legs. It is very important that the hip should be pushed forward in each stride and that this is concerned solely with the equilibrium and co-ordination of the gluteus major, biceps and quadriceps. Then, as a consequence of an economical and elastic running stride, the triceps surae and plantar flexor muscles come into action. All this implies the inclusion in the training programme of hundreds of exercises covering the indicated objective.

One should also not forget to include in the daily warm-up exercises for technique modelling and for the development of elastic strength. Lastly, semi-sessions of training purely for speed, with short repetitions (60m) and ample recovery should be included. In due time, the distances will be increased and the rest pauses shortened.

PATerson:
The type of drills that could be used for the development of speed for the 800 metres could include warm-up drills, such as skipping, high-knees, heeling, hip rotation, backward runs, leg swings, fast feet and ankleing. All these provide the athlete with the movements and co-ordination necessary for fast running. These drills can be used throughout the year.

Another set of drills will correct and ground in the proper biomechanical movements that are important for running at speed. The circuit can be set so that specific body parts are strengthened and the exercises performed at speed, with a specific recovery between each station. It is essential that each exercise is performed correctly. Circuit training can include plyometrics - a method of training used by Coe.

Running up hills is another way of developing the speed necessary to run a fast 800 metres. 5 to 10 seconds runs can be used to develop the Creatine Phosphate (CP) system, and 15-30 seconds runs for the lactic power system. Both methods could be used in the specific phase of training.

SCHMIDT:
In answering question number four, I have already pointed out several drills to develop speed. They are well-known and it would be too much to go into detail as one could write a complete essay on the structure of sprint training for the 800 metres.
5. What sort of drills would you use for the development of speed for the 800 metres runner?

**VITTORI:**
The technical and rhythmic exercises which will act as the biomechanical support for the development of speed are as follows:

- bounding runs over distances of 100/200m;
- faster bounding runs over 100m;
- high frequency sprints over 100m;
- long-striding sprints over 100m;
- running at varying speeds, over distances of 100/150m, changing pace every eight strides (both fast and more slowly).

6. How would you plan competitions and time trials during the preparatory period in terms of distance, number, aims and position in the training phase?

**DIAZ GAMBOA:**
I use a "Cooper Test" at the beginning of the preparatory period, to assist with the planning of the first stage of the general preparatory period. After the sixth microcycle, I would give an over-distance test of a maximum speed 1000m run, and then, after a pause of 10 to 15 minutes, an under-distance test of 600m. This would be repeated at the end of the preparatory period.

**ELRICK:**
In our programme, we plan 3 or 4 indoor competitions in the period mid-January to the end of February, basically to coincide with the available meets. Ideally, we look to have our athletes run distances from 600 metres to 3000 metres. Our aim is to evaluate where the athlete is in terms of speed and endurance. Of course we do not have a specific preparation for these events.

**HERNÁNDEZ MORA:**
Preparatory – practice tests, over distances of 500m, 600m and 1000m.
Pre-season – Training controls or competitions over 800-400m. Should be done at the end of each meso-cycle, so that adjustments may be made to the next meso-cycle if necessary.

**MARTIN:**
For athletes having a single yearly macrocycle and arriving at supreme fitness during a 5-to-6 week period during July-August, serious competitions are unnecessary until June. However, the "art of competing" must not be forgotten, and the reason for training, i.e., eventually to race, must be kept in perspective. Thus, it is entirely appropriate to include periodic competitive experiences, realising that freshness for such racing may not prevail, because the long arduous training period carries with it a sizable chronic fatigue component, caused by the strength and endurance building work loads. Such periodic "tests" of improvement can be inserted, to see "where one is" in comparison to the previous year, or since the previous test, and can also serve as the equivalent of a hard training effort. Depending on the athlete's interest, as well as place of residence, such "tests" might include road and cross country races, shorter-distance legs of an ekiden or stage relay, track time trials, indoor races, and more. It is useful for the weather and other environmental conditions to be fairly optimal, so that the test results are not adversely affected by widely variable circumstances.

**PASCUA PIQUERAS:**
For several years we have used the Bosco Test to measure strength and the amount of lactate in aerobic and anaerobic events. The following is a summary of the tests carried out:
Nov. Incremental lactate runs to observe VO₂ max, and the aerobic-anaerobic threshold.
6. How would you plan competitions and time trials during the preparatory period in terms of distance, number, aims and position in the training phase?

Dec. First test for strength:
CMJs without weights, 5 reps.
CMJs with weights increasing from 20kg to each athlete's maximum.
Continuous jumps without weights, coming down to 90 jumps in 60sec.

Feb. Horizontal multi-jumps: 100m (registering the number of jumps and time taken) 2 x 150m at 100% effort and with complete recovery.

April Second test of strength: same as the first test.

May Lactate test: 2 x 600, the first at 80% and the second at 100% effort.

This latter test is always carried out at the end of the 'unloading' weeks and its results condition the future training plan.

Trials

Feb. Without preparing specially for indoor racing, compete in a 3000 or 800. Objective: to gauge the progress of basic aerobic preparation and, to some extent, the anaerobic component, with no special training for it.

Jun. Early competition: 1000-1500-2000 in unimportant races, also including 4 x 400m. Also 3-5 races over 800 metres at a higher level.

Jul. Strengthening of weak points, resuming work for aerobic, regenerative strength and the final lactate phase.

Aug. Top level competition.

PATERSON:
This type of planning is again specific to the country the athlete comes from and also the personality type of the athlete. Some athletes deem it necessary to have time trials, in order to know how they are going in training but, if a time trial goes badly, it may take a few weeks to build up the athlete's confidence. So much depends on the preparation phase and how long that phase is, but some athletes like to do the same competition each year and compare their times from previous years.

For example, in Britain there are many popular road relays, which take place during the preparation phase of training; athletes such as Coe, Cram, Ovett and Elliott have used them to gauge how their training is progressing. These athletes will pick a specific race, run in it each year and compare their times with those of the previous year. In Norway, there are indoor meets which can give an indication of the athlete's fitness during the winter months. If time trials are considered necessary, they should be carried out systematically, so that comparisons can be made. For example, a 1200 metres time trial could be undertaken each year on the first Saturday of the third month of the preparatory period. Some coaches like to have regular time trials but certain track sessions, carried out at the same time each year, will also give the athlete a good idea of how he/she is progressing.

SCHMIDT:
Whether I use single or double periodization pretty much depends on the goal that has been set; for example, perhaps the achievement of an excellent performance both indoors and then again in the outdoor competition period. I assume here we are dealing with a double periodization, where it is necessary, for example, to plan several indoor competitions prior to the European Indoor Championships, not only 800 metre races though, but a mixture of fast 400 metre races, a few 800 metre and some over-distance ones. I would also like to point out that
it has proved of benefit to include cross-country races early in the season, i.e. in November/December and probably January, because these races help to develop the athlete's willpower and other necessary skills. It is interesting, also, that good indoor performances may be achieved without having too many competition-specific sessions. I think it is enough to include well-structured fartlek runs, together with more extensive, intermittent loads (e.g. 4–6 x 1000 metres) and sometimes, if an indoor track is available, shorter, faster runs, which should, however, not be too many.

**Vittori:**
In the early stages of the competition season the athlete should stimulate the development of speed by means of 3–4 competitions over non-regulation distances, such as 300/500/600 metres, before concentrating on the 800 metres. This will serve to bring the athlete up to competitive standard and also to assess the true level of his speed and speed/endurance ability. As the year progresses, he should also run some 400 metre races, so as not to become too set on just one distance. In any case, the athlete should not run in too many 800 metre races, since this could weaken him, especially if he is continually pushing himself to the limit.

**Díaz Gamboa:**
It is obvious that to run the first lap of an 800 metres race very close to the athlete’s best time for the 400 metres will have a great effect on the total time taken for the second lap, increasing the time taken by about 11–12 seconds. Therefore, the determination of the optimum time for the first lap is vital for the achievement of a good performance. I recommend running the first lap 4 to 4.5 seconds slower than the athlete’s best 400 metres time, and the second lap 4 to 5 seconds slower than the first lap. Thus a 50 second 400 metre runner would have to cover the first lap in 54 to 54.5sec and the second lap in 58 to 58.5sec, to achieve a time of 1:52 to 1:53.

**Elrick:**
My experience with the use of pacemakers has been positive. We usually use this tactic when seeking fast times. Of course you are relying on the pacemaker to split in the proper time. Yes, too fast a pace can lead to disaster. However, fast times are achieved when a properly prepared athlete takes the risk.

**Hernández Mora:**
If there is no adequate planning of racing rhythm during the preparatory stage of training, this kind of error can occur. Careful preparation is necessary to avoid this. It can be tested by means of pre-season competitions.

**Martin:**
If there are pacemakers, the bona fide athletes in the race will experience the energy saving that results from being in the pacer’s wind shadow. If the pacemaker goes out at a pace that is too fast, even for the bona fide athletes, even taking into account the saving of energy, yes, those athletes will experience excessive acidosis by the end of the first lap and, as they then do their second lap with no ‘wind shelter’, a rapid slow-down may occur. This points out the importance of effectively choreographing such a race – the pacemaker must make the proper pace, i.e., a pace that matches the abilities of those athletes for
7. Too fast a pace in the early stages of a race often result in a poor finish and poor overall time. Do you think that the use of pace makers often leads to this?

whom the energy saving is intended, thus assisting them to maintain an optimum pace over the second half of the race. (As a philosophical aside however, one could question whether such paced races are really "aided" races, and thus whether they should be eligible for "record" consideration.)

**PASCUA PIQUERAS:**
I believe that the 'hares' have simplified the tactics of the 800 metres and have helped to produce excellent times. Naturally, the finishes are slower, but this happens in all fast races. In the 800 metres the final stretch is run at a slower pace than in the 10,000 metres, but that is logical. The present world records for the 800 metres were established with a much slower second lap (Kratochilova's 1:53.28min with 56.1 and 57.2sec, Coe's 1:41.7min with 49.7 and 52.1sec) And the best times have always been produced by a balanced run, but with the first 400 metres much faster than the second. Evidently, if the aim is to run a 54sec pace, it is no wonder that an athlete can register a time of less than 24sec for the last 200 metres, but with a poor final result. The problem is to be capable of 50sec for the first 400m, 1:15.5min for the 600m and finish with a 26sec last 200m, and this will happen only with excellent pacemakers, who keep to the correct pace for the first 600m.

**PATERSON:**
Pacemakers are employed only for the specific purpose of making the race fast from the gun. If they go off too fast, then the race can be spoilt. Finding the ideal pace is left to the few athletes who travel the world, making a living by providing the right pace for a part of the race. These athletes will run only the first 400 or 600 metres of an 800 metres race. Sometimes less experienced pace-makers will go off too fast and this will usually cause a poor result. Only in Championships do we see the race run without pacemakers, which is really the true form of competition. Then tactics come into play and the top athletes show what changes of pace they can make and how they can deal with different situations.

**SCHMIDT:**
I think it is wrong and unfair to put the responsibility for poor races on to pacemakers not having established an economic pace, because of erratic running or maybe going too fast in the first lap. In my opinion, pacemakers should be used in international meetings and they should be selected carefully - the most efficient ones are top 800 metre runners themselves - and the racing strategy has to be directed respectively from the outside. Then each athlete is asked to run his race, following the pacemaker according to his own ability, so that it is an optimal race, maybe rewarded with a personal record. But I would also like to say that, especially in junior competition, pacemakers should be used only occasionally and very carefully, as otherwise the tactical sort of behaviour demanded in championships cannot be developed.

My final comment is that, in my view, a national or a world record achieved during a championship race is worth much more than one achieved with the aid of one or two pacemakers! As an example of this, I would like to name Willi Wülbeck, who, in 1983 in the 1st World Championships in Athletics in Helsinki, not only won the race but set the German record of 1:43.65, which stands to this day.

**VITTORI:**
Going back to the opinion expressed at the conclusion of the previous question, one must condemn the widespread use of pacemakers, which
7. Too fast a pace in the early stages of a race often result in a poor finish and poor overall time. Do you think that the use of pace makers often leads to this?

has been the cause of two great failings. The first of these is the dearth of top class specialists, as these gradually disappear, burnt out by too many competitions run at a crazy pace. A second harmful result of the use of pacemakers is the way in which the world record at the distance has lagged behind that for other distances which centre on speed (especially the 400 metres). I stated earlier that the 800 metres record should be at least 1:39min to be equivalent to that of the 400 metres. We must not forget that four rounds have not been run in the 800 metres at a major international championships since the 1984 Olympic Games. Some competitions should be removed, limiting the number run during the year to 8/10 and totally excluding the use of pace makers. We should not overlook the importance of studying a new strategy in the distribution of effort, which cannot allow a first lap of 49.5 and a second of 52.3 to achieve 1:41.8 min. Why not do it the other way around, at least once? It should be clear that this is intended as a provocation, but it would actually be better and, furthermore, possible to run the two halves of the race in more or less equal times. For example, each lap could be run in 50 seconds flat, if the athlete were capable of running 45.5sec in the 400 metres, with an absolutely realistic differential of around 9sec.