Peaking for the Major Competition

Author: Tudor Bompa (CAN)

The objective of any training program is to peak and attain the highest performance at the major competition(s) of the year. The achievement of peak performance is the direct outcome of an athlete's adaptation to various types of training. In order to increase an athlete's chances of success, the coach plans various activities which cumulatively will produce the proper result at the proper time.

Peaking is not a psychological mystique, but rather a very complex training state which is attained in a sequential manner. As illustrated in figure 1, at first the athlete reaches the state of degree of training, followed by athletic shape. Peaking is initiated from here.

Figure 1: An illustration of the accumulation and elevation of training states (hypothetical).

Degree of training is the foundation of training states. It is reflected by above-average performance, a high level of athlete efficiency with a high rate of recovery, a good level of skill proficiency, and psychological readiness. An athlete who reaches a high degree of training has a very high level of physical preparation and has perfected all the biomotor abilities required for his/her sport. The higher the degree of training, the higher the organism's effectiveness. When the degree of training is poor, other training states cannot be reached. This lowers the magnitude of athletic shape and, as a result, peaking. Athletic shape is an extension of the degree of training and is characterised by performances close to the athlete's maximum, sport-specific fitness, technical, tactical efficiency and a psychological base from which peaking can be initiated.

Peaking is the highlight of athletic shape. It is the scheduling of activities prior to major competition(s). Its goal is to ensure optimum performance. Peaking is also a temporary state of training produced when physical and psychological elements are maximised and when the levels of technical and tactical preparation are optimal. During this state of training, the organism's adaptation capacities are maximal as well, and the neuro-muscular co-ordination is near perfect.

Peaking is a superior, biological state characterised by perfect health, a quick adaptability to training stimuli and a very good rate of recovery. The organism has a high state of synergism - the joint action of several agents which together increase each other's effectiveness.

The biological characteristics of peaking vary according to the type of sport (Table 1).

Table 1: The characteristics of peaking for various groups of sports.

Group of Sports	Characteristics
1. Dominant Anaerobic	A high capacity to mobilise an organism's functions and an extremely rapid rate of recovery.
2. Dominant Aerobic	High working capacity based on very high efficiency.
3. Combined Aerobic and Anaerobic	Capacity to handle many moments of maximum stimulation.

From a psychological point of view, peaking is a state of readiness for action. The athlete's nervous system adapts quickly and efficiently to the stress of competition.

Athletes who reach this training state are also highly motivated and can tolerate various degrees of frustration which occur before, during and after competition. To produce this level of tolerance, a coach can create many training sessions so the psychological stresses specific to the main competition are created.

1. Factors Which Affect Peaking:

Peaking is an intricate task. No one thing can lead to its accomplishment. There are, instead, several factors which have to be considered. It is important to point out that one factor cannot be substituted for, or compensated by, another. All factors are essential.

A. High working potential and quick rate of recovery are two essential attributes of any athlete who reaches a high training status. An inability to cope with a high volume of work means that high performance expectations are likely unattainable. Similarly, the organism must be able to recover quickly following training and competition.

B. Near perfect neuro-muscular co-ordination refers to an athlete's capacity to perform skills and tactical manoeuvres almost flawlessly in the performance of a routine or skill. Technical imperfection in the performance of a skill usually reduces overall performance.

C. Unloading is a process of progressively decreasing the impact of the stressors (physical, technical, tactical and socio-psychological) an athlete is exposed to in training. This can facilitate a functional and psychological arousal for a competition.

A correct unloading phase prior to the main competition is one of the most important factors in peaking. This phase, which usually follows a long period of hard training and many competitions, aims to regenerate all of the organism's systems, especially the central nervous system (CNS) and the athlete's psyche.

Unloading is usually attained through a reduction in the volume and intensity of training so the athlete may rest and replenish his/her energy reserves. The volume of training is a quantitative component which incorporates time, distance, number of repetitions, etc. The intensity of training is a qualitative component, i.e., velocity, complexity of skills, performed in a given unit of time.

The concept of unloading should be regarded as the enhancement of the finest physical and especially psychological readiness of athletes. For well-trained athletes, the duration of the unloading phase should not exceed two weeks.

The approach used during the two weeks of the unloading phase varies from sport to sport. Figure 2 illustrates a situation in which endurance is the dominant characteristic (i.e., cross country skiing, 800m and 1500m running, swimming, etc.).

Figure 2: The dynamics of volume and intensity during the unloading phase for sports where endurance is the dominant characteristic.

In the first week of unloading, the coach reduces the intensity of training. The number of training sessions is also reduced to a maximum of two per day. The number of intensive sessions may not exceed two per micro-cycle (a weekly training plan) and their duration should be reduced to a minimum. Other activities outside of the sport-specific skills, i.e., weight training, should be eliminated so that time can be used for recovery techniques.

The volume of training may be the same as in previous micro-cycles, or slightly less. Training should include mostly medium and low-intensity methods where the aerobic component is dominant. Such a program is least stressful, but satisfactory in maintaining the level of physical preparation.

In the second week, or the micro-cycle of the main competition, the intensity of training is drastically reduced so stressful activities are eliminated. This allows the athlete to completely regenerate prior to competition.

A different approach is suggested for sports where speed, power, or co-ordination are the dominant characteristics, i.e., sprinting, gymnastics, etc.

As illustrated by figure 3, in the first micro-cycle, the volume of training should be reduced to about 50 percent of the previous cycle's level. A micro-cycle with two

peaks may be used but the intensive training sessions should have long recovery intervals between peaks.

Figure 3: The dynamics of volume and intensity of the unloading phase for sports where speed and/or power are dominant characteristics.

Most exercises done during intensive training should be dynamic, but of short duration and not heavily loaded. Outside of the two intensive sessions, the workouts should be submaximal and alternated with moderate or low-intensity sessions. Weight training should be excluded.

During the main competition's micro-cycle, the volume of training continues to fall while the intensity, which is also progressively reduced, may have one peak in the first part of the cycle, but not of a high intensity.

Figure 4 suggests the approach which may be considered for sports in which both the volume and intensity of training have relatively equal importance (i.e., team sports).

Figure 4: The dynamics of volume and intensity for the unloading phase for team sports where both the anaerobic and aerobic energy systems have an almost equal contribution.

In the first week, unloading is produced by reducing the volume of work. Only one peak may be necessary during the week. Intensity is progressively reduced, but the

coach can still have two intensive training sessions of 60 and 50 per cent of maximum.

In the second week, both curves of intensity and volume taper down. Volume falls to a lower point than intensity. However, even during this week, a micro-cycle with two peaks may be planned. The first peak should be 30 to 40 per cent of maximum and the second 25 to 30 per cent.

Two days before the main competition, training is still scheduled, but it must be short and of low intensity (see Figure 4). During these sessions, enjoyment, confidence building, optimism and team spirit should be striven for.

D. Overcompensation (Figure 5) is the foundation of an athlete's adaptation to the training stimulus. When an individual is training, he/she is exposed to stimuli which disturb the normal biological state by burning supplementary foodstuffs. The outcome is fatigue and this temporarily reduces the athlete's ability to do work. (Phase I)

Figure 5: The overcompensation cycle.

Following training, there is a phase of recovery during which the biomechanical sources of energy are not only replaced (compensation or phase II), but may surpass initial levels by acquiring reserves. This enables the athlete to rebound (overcompensation or phase III).

If the resting phase, the time between two training sessions, is excessive, overcompensation will fade away, leading to a process of involution or a phase IV of little or no improvement in performance.

Overcompensation is the effect of work and regeneration in the athlete. Correct unloading is needed to achieve overcompensation prior to the main competition.

Figure 6 illustrates the last five micro-cycles before the main competition. While during the first three cycles the load in training is still progressively increased, during the last two, the coach unloads the program to facilitate overcompensation.

Figure 6: Correct unloading prior to the main competition helps to produce overcompensation.

E. Recovery and adequate regeneration following training and competitions are important factors in peaking. If recovery techniques are not consistently utilised, the athletes become fatigued. This fatigue may evolve into physical and neuro-psychological exhaustion. Obviously, under such circumstances, performance expectations should be drastically altered.

F. Motivation, arousal and psychological relaxation are instrumental for peaking too, since during training and competitions the athlete is exposed to various physiological and psychological stresses such as fears, threats and national pressure. Therefore, relaxation techniques, massage, and biofeedback are instrumental.

Athlete motivation can be elevated for the competition if high, but realistic goals are set. A high level of athletic aspiration, performance improvements, prestige, recognition, social status, etc. represent important motivators.

Crucial to the athlete's psychological well being prior to competition is the coach's ability to ensure a relaxed environment.

G. Nerve cell working capacity. An athlete whose training is properly developed for competition cannot maximise his/her abilities unless the CNS is in an excellent state and thus has a high working capacity.

Under optimal conditions, the nerve cell's high working capacity cannot be maintained for long. It may be considerably increased only during the last 7-10 days prior to the main competition and may, in fact, be the normal outcome of recovery, relaxation, and overcompensation.

Athletes' activities - the performance of skills - are the outcome of muscular activities caused by nerve impulses. Thus, the force, speed, and maximum number of contractions depend on the nerve cell's working capacity. Such capacity depends not only on the athlete's training state, but also on the cell's level of excitability.

A nerve cell's high working capacity cannot be maintained for a prolonged period of time without the cell becoming strained, or fatigued. When training demands reach the nerve cell's limits, or when the athlete drives himself/herself over such

limits, the cell reacts to training or competition stimuli impairingly. Under such circumstances, the athlete's working capacity decreases abruptly.

In order to protect itself from further stimuli, the nerve cell assumes a state of inhibition, restraining its processes. Certainly, the athlete, calling on his/her will power, may continue to train, but progressively he/she may be driven to complete exhaustion.

Under such circumstances the athlete's performance is far below normal levels. This is why regeneration micro-cycles and training sessions are so important.

The dynamics of nerve cell excitability vary according to the proximity of the date of competition. The excitability increases progressively during the days prior to the competition, reaches its maximum peak during the day(s) of the contest and decreases following competition (Figure 7).

Figure 7: The dynamics of CNS excitability level before, during and after competition (modified from Ozolin, 1971).

Although in most cases excitability levels decrease to normal after competition, they may fall below normal. This signifies a high level of exhaustion. Under such circumstances the training program should be light. This should enhance a full regeneration prior to commencing a normal load.

Athlete peaking and excitability may be affected by the dynamics of training work loading and overcompensation.

Figure 8 (a) illustrates a situation in which an athlete peaked too early because of: 1.) exaggerated intensive training, and 2.) a heavy competition schedule during the pre-competitive or competitive phase.

Under such circumstances the main competition of the year fell in the phase of post-start decrease. Figure 8 (b) shows a case in which the best performance was achieved on a later date than the main competition.

As is often the case following an important competition, there are several days of relaxation and light training, which likely enhanced overcompensation in this case. Or, peaking wasn't achieved by the date of the main competition perhaps because the coach did not unload properly and overcompensation did not occur.

Figure 8: Early peaking (a) and late peaking (b).

A. A calendar of competitions is important in periodisation and may enhance or adversely affect peaking for the major contest(s).

Some coaches believe an athlete has to participate with maximum effort in every competition. Obviously, in such a case, the athlete is constantly exposed to stressful activities, which might not lead to an optimal season culmination.

Similarly, a heavy competitive schedule requires many regeneration dates which disturb normal training. Also of concern is the intense psychological stress level an athlete must reach to attain an adequate state of arousal for each competition.

In planning and selecting competitions, except for those set by national and international sport governing bodies, the coach may employ the grouping or cyclic approach.

1. The *grouping* approach involves allocating two to three weeks in a row during which the athletes take part in competitions where they participate in several events per weekend. Figure 9 illustrates such a phase. It is usually followed by a macro-cycle of training only. This allows the athletes to train for another two-to-three-week block of competitions. (A macro-cycle is two to six weeks of micro-cycles.)

Figure 9: A hypothetical example of a grouping approach for a team sport

Training Phase	**Competitive Phase**								
Dates	**May**					**June**			
	1	**8**	**15**	**22**	**29**	**5**	**12**	**19**	**26**
Macro-cycle	6			7		8			
Calendar of Competition				X	X				

Competitive Phase												
July					**August**				**September**			
3	**10**	**17**	**24**	**31**	**7**	**14**	**21**	**28**	**4**	**11**	**18**	**25**
9			10					11				
X	X	X										

The hypothetical example illustrated by Figure 9 suggests that at the end of May the athlete/team takes part in a group of competitions spread over two weeks. In each case, competitions are organised over two to three days each weekend.

The first micro-cycle following the first set of competitions is a lower intensity cycle, with one peak at the end. The first part of the cycle (two to three days) is

dedicated to regeneration and low intensity and calm training sessions are organised.

Next, two and a half micro-cycles are planned for hard training, followed by a short unloading phase (two to three days) and again three weeks of competitions.

August 21 is hypothesised to be the qualifying competition for the main championships of the year on the weekend of September 25. For training, the macro-cycles preceding the qualifying and final championships follow the same pattern as the previous ones.

The grouping approach is most suited to individual sports, where the only two competitions are planned in a manner similar to the above. For team sports, such an approach may be utilised only for international competitions, where the grouping concept is a typical model for training for an international tournament.

2. The *cyclic approach* may be used in individual and team sports. Competitions are planned in a repetitive, cyclic manner (figure 10).

Figure 10: A hypothetical example of a cyclic approach for a team sport.

Training Phase	**Competitive Phase**								
Dates	**May**					**June**			
	1	**8**	**15**	**22**	**29**	**5**	**12**	**19**	**26**
Macro-cycle	7					8			
Calendar of Competition		X		X		X	X	X	X

Competitive Phase												
July					**August**				**September**			
3	**10**	**17**	**24**	**31**	**7**	**14**	**21**	**28**	**4**	**11**	**18**	**25**
9							10			11		
X	X	X	X	X	X	X						

The competitions during macro-cycles eight and nine are league games, planned for each weekend. Then, at the end of macro-cycles 10 and 11, the regional and final championships are planned. Since each micro-cycle ends with a game, each may be structured with one peak only, which usually should be on Tuesday or Wednesday.

One or two days prior to the game, there is a progressive unloading phase to enhance overcompensation for the day of the game.

For individual sports where there are no league competitions but only qualifying and final competitions (main competition of the year), the cyclic approach may be considered as in Figure 11. In such a case, the coach decides to take part in other competitions organised by various clubs.

Assuming there are several competitions to choose from, the coach plans to take part only in those which enable a cyclic approach. Consequently, athletes will compete every second weekend, with the time between competitions devoted to training.

Figure 11: A hypothetical example of a cyclic approach for a cross-country skier.

Training Phase	**Competitive Phase**								
Dates	**November**					**December**			
	1	**8**	**15**	**22**	**29**	**5**	**12**	**19**	**26**
Macro-cycle	7					8			
Calendar of Competition				X		X		X	

Competitive Phase											
January					**February**				**March**		
3	**10**	**17**	**24**	**31**	**7**	**14**	**21**	**28**	**4**	**11**	**18**
8 (continued)			9					10			
X		X									

Such an approach is advantageous because the coach can modify training programs according to the feedback received during the competitions. Naturally, this will enhance an ideal preparation for the main competition.

B. The number of peaks per competitive phase is also important in peaking. The hills and valleys of the athletic shape curve depend separately on each peaking factor. When the coach integrates all these factors properly, peaking should take place.

Throughout the competitive phase there may be two to four very important competitions, which are not spread out evenly, or in order of importance. Therefore, the curve of peaking (Figure 12) should be altered according to such a schedule.

Figure 12: A hypothetical calendar of competitions and the curves of athletic shape and peaking.

An attempt to peak for all competitions would be impossible because of the limits of the nerve cell's working capacity and excitability. Such an approach could lead to exhaustion. More likely, the cell will protect itself by refusing to react to external, or competition, stimuli.

Studies of techniques used for long-term planning reveal some precise peaking data. It has been found that seven to 10 competitions are enough to reach a high state of readiness for major competitions. Also, in an annual training plan, most elite class athletes require 32-36 micro-cycles to reach peak performance of the year. Assuming an athlete is involved in daily training sessions, it has been found that peaking may be reached after only 65-80 per cent of the total days of training.

One may conclude that peaking cannot be reached quickly, but rather after a hard and prolonged effort. In general, it may take 200 days of training before an adequate physical and psychological capacity for peaking is reached.

The greater the number of important competitions or peaks per year, the less the number of training days required. If two to four peaks per year are planned properly, this should not represent an impediment since peaking may be achieved, and accumulated, sequentially.

To accomplish higher performances every year, the degree of training has to be increased as well. This could be done by raising the physical level of training from year to year. On such a solid foundation, a higher plateau of athletic shape may be realised from which higher peak performances will be attained. Ignoring such an approach leads to a plateauing-off of an athlete's performances, rather than a continuous improvement.

2. Methods of Identifying Peaking

The identification of peaking is both difficult and controversial. One of the best methods seems to be the dynamics of the athlete's performances.

Track and field athletes were used in a peaking study. Considering the previous year's personal best performance as a reference point (or 100 percent), the first zone, or the zone of high results, was considered to be performances less than 2.0 percent below the reference. Medium results were those within 2.0-3.5 percent below the best performance and low performances 3.5-5.0 percent below. Finally, the fourth zone was reserved for performances over 5 percent lower (poor performance).

It is suggested that when an athlete can achieve performances within the first zone, he/she is in high athletic shape and likely close to a peak performance. Once this point is reached, peaking can often easily be obtained.

When athletes achieve performances classified in the first zone, the organism's adaptation to training is complete. The reaction to training stimuli is consistent, and as a result, the heart rate taken early in the morning reaches consistently low levels.

In addition to this, other data may be considered. These include a urine biochemical test, hand grip test, electrocardiography in resting conditions and aerobic or anaerobic power tests.

Obviously, such tests have to be performed by qualified personnel. Data from various phases of training, especially during the competitive phase, are collected and compared. When all scores are superior, the coach knows his/her athlete is in a very good state of training.

3. Coach/Athlete Relationship in Peaking

Of great importance is that the coach must be in good shape as well. The coach's behaviour, optimism, confidence, enthusiasm, encouragement, and cheerfulness

also represent an important prerequisite for an athlete's peaking, especially when the relationship between coach and athlete is very close.

The coach is not only responsible for training, but for peaking the athlete psychologically too.

A coach has to be psychologically well balanced and calm, or at least appear well balanced and calm, prior to a competition.

A well-controlled behaviour has a tremendous impact on the athlete. A coach must strive to neutralise as many of the stressors as possible (peers, job, etc.) that might affect an athlete's performance.

4. Duration of Peaking

Little precise research data exist regarding this crucial training question. Among coaches and athletes there exists, as well, a wide range of opinions.

The myth that an athlete can peak only once a year for a day still exists.

It is reasonably safe to say the duration of peaking is very individualised. The training program followed by each athlete has a substantial influence on the duration of peaking.

The longer and more solid the preparatory phase, the higher the probability of prolonging the athletic shape and consequently the peaking.

It is rather difficult to separate peaking from athletic shape. As already explained, athletic shape is a very high plateau during which the athlete has a very high working and psychological capacity. The highlight of this plateau is zone one, when an athlete's performances are within 2 per cent of the previous year's peak performance. Assuming the coach organises an adequate training program, the duration of zone one may be 1.0-2.5 months. The duration of peaking may be 7-10 days since the nerve cell's optimal working capacity may be maintained that long. Obviously, following each peaking for a top competition, a short phase of regeneration is strongly desired, followed by training.

The duration of peaking, as well as zone one, may be affected by the number of competitions. The longer the phase of weekly competitions, the lower the probability of duplicating high results. A high number of competitions does not necessarily lead to good and progressively higher performances. Often there is an opposite effect - results decline towards the end of a competitive phase, when championship competitions are usually planned.

After the end of the eighth micro-cycle of competition, there often begins a critical phase. Performance need not necessarily suffer, however. A coach should be more aware of the need to alternate between stressful and regenerative activities. An important method of ensuring adequate peaking is to prolong zone one and consequently the ability to peak. A competitive macro-cycle should usually end with a very important competition. This ensures a progression in the competitions.

The grouping approach to planning competitions allows not only the alternation of phases of training with periods of competitions, but also a lengthening of the period of athletic shape.

Also important is the time required to reach zone one. Although this might differ with each athlete, the average time needed to move an athlete from a pre-competitive level to zone one is about four to six micro-cycles.

During the first three to four cycles, dramatic increases may not be seen, since intensive work results in a high level of fatigue. But after the last one to two cycles, when the athlete has adapted to the training load and when a slight decrease in the stress of training allows overcompensation, higher performance is possible.

As a general guideline, gymnastics and water polo might take six micro-cycles, athletics, rowing, swimming and wrestling approximately four.

5. Factors Which Might Adversely Affect Peaking

Peaking is the natural outcome of several months of hard work and a properly planned training program. Several factors may adversely affect peaking, and it is the coach's responsibility to control them.

A. Factors Related to Competitions

Before taking part in a competition, both the athlete and coach expect normal, standard conditions. In fact, an athlete may expect perfect circumstances. As a result, every unforeseen change may affect the athlete's peaking and performance.

Strong wind or heavy rain may disturb athletes who are not familiar with them. Waves produced by wind can substantially affect performances in canoeing and rowing, especially when the athletes use improper technique. A wet or muddy field dramatically reduces ball control in sports like football and soccer.

In cross-country skiing, a peak performance is directly dependent on the quality of the snow and the ability to wax promptly. Similarly, all athletes are affected by extreme temperatures and altitude.

The answer to all the above problems is model training - the training of athletes under all conditions.

Of no less impact on athletes are changes in the draw, biased officiating and an adverse audience. Exposing athletes to competitions which duplicate the characteristics of the main competition is a necessary prerequisite to peak performance.

B. Factors Related to an Athlete's State

The coach can observe and, therefore, have direct control over the athlete only during training hours. However, what the athlete does between training sessions must also be known by the coach since inadequate sleep, use of alcohol, smoking, poor diet, etc. can reduce an athlete's rate of recovery and adversely affect training.

Similarly, dissatisfaction with family, coach, peers, school/work, etc., reflects negatively on an athlete's attitude during training and competitions.

Therefore, the coach should observe the athlete, collect information from persons close to him/her and make all possible attempts to correct negative attitudes and behaviour.

C. Training and the Coach

Training programs planned improperly, with overly high intensity, quick increases of intensity, or too many scheduled competitions are not only very stressful and taxing, but also impair adequate peaking.

The effect of such mistakes is even more obvious when the competitive phase is very long. Under such circumstances the maintenance of zone one, and a correct peaking for the main competition, (usually at the end of the phase), is almost impossible.

Overlooking the need to alternate work with regeneration may not only reduce an athlete's ability to peak but may even lead to injuries.

A coach's knowledge, attitude, behaviour and inability to disguise personal emotions and frustrations can also affect an athlete's performance. A lack of confidence in the coach's abilities and knowledge, especially if present prior to the main competition, will obviously affect an athlete's performance and, therefore, peaking for that contest. The solution is relatively simple. A coach may require more training knowledge or improved self-control. If a coach cannot deliver these assets, he or she should be honest and advise the athlete to look for another coach.

6. Summary and Conclusions

The entire training process, its planning and structure, is geared towards reaching the peak performance for the main competition(s) of the year. This is the supreme scope of training and, as a result, everything else revolves about it.

Hard work is an important but not singular training attribute. If one expects peak performance to be adequately achieved at the time of the main competition(s), then hard work has to be judiciously complemented by a well-periodised and planned training.

To reach peak performance for a given competition is a very complex task. However, such a task can be simplified if the coach properly comprehends and manipulates all the factors affecting peaking. Only such a refined and comprehensive knowledge will transform peaking from a myth to a well-controlled, training reality.

This article was printed with the permission of the Coaching Association of Canada.

The Taper Period

Author: Ernest Maglischo (USA)

The Taper Period*

The taper period comprises the final 2 to 4 weeks of the season and culminates in the most important meet, usually a championship. The resting process for such a meet is called a major taper. The usual practice is to plan for one major taper per season. Swimmers may also take minor (shorter) tapers and retapers during the season. A minor taper is used when a good performance is needed at a particular meet prior to the championship. The process of retapering refers to a second taper following closely after a major taper.

Coaches seem split over the advisability of minor tapers. Some feel they interfere with training and prevent swimmers from achieving peak performances. Coaches who favor several tapers point out that many swimmers have been able to equal or improve their times in subsequent tapers. They feel, therefore, that swimmers can use several minor tapers with no detrimental effect at season's end. The process of retapering is becoming more important as an increasing number of swimmers must go through a major taper prior to a championship in order to make the cutoff times for entry into the meet. There are also an increasing number of international competitions following national meets that require retapers.

Logic favors one major taper per season with perhaps one or two minor tapers. Tapering too frequently can cause swimmers to lose valuable training time and their conditioning may deteriorate as a result. A typical winter swim season is 20 to 24 weeks in length. The summer season may be 10 to 14 weeks long, depending upon whether training begins in April or June. Since each major taper reduces training time by 2 to 4 weeks, with minor tapers interrupting training for 3 to 7 days, a considerable amount of training time would be lost by swimmers who had gone through 2 or more major tapers and several minor tapers during a season. The time spent in training could be reduced by 50 percent as a result. No more than one major taper per season is recommended. Minor tapers are recommended only when absolutely necessary.

Physiological Factors in the Taper

The improvements of tapered swimmers are well documented. It is not unusual to improve 1 to 2 seconds in 100 races and 2 to 4 seconds at the 200 distances. Improvements of 4 to 8 seconds are commonplace at distances of 400 meters and 500 yards, while improvements of 20 seconds are not uncommon in the 1,500-meter and 1,650-yard freestyles.

The reasons for these improvements have not been identified at the present time. Some people have theorized that carbohydrate loading may be involved. This is a possibility in races of 400 meters and longer. However, it does not explain the tapered performances of swimmers in shorter events, nor does it explain why 2 to 4 weeks are required to produce a taper effect. Carbohydrate loading can be accomplished in 2 to 3 days.

Although we cannot identify the physiological factors involved in producing a taper effect, we can theorize as to the training stimulus that produces it. Training has repeatedly been shown to produce temporary overcompensating (super adaptation) effects on body physiology. It is reasonable, therefore, to assume that the process of tapering involves some as yet unidentified physiological overcompensation effects. It is conceivable that future research will demonstrate that a long period of training followed by a short period of rest will produce a super adaptation effect where such mechanisms as enzyme activity, lactate removal, and buffering capacity are concerned.

The stimulus for a super adaptation effect in these and other physiological mechanisms may be a training program that does not permit complete recovery from day to day. That is, some components of the training program could be depleting certain metabolic reserves faster than they can be replaced. After 10 to 20 weeks in which these metabolic processes are operating near peak capacity in their attempt to replace the resources that are being depleted, they become so conditioned that they continue supplying energy at high rates during the 2 to 4 weeks that follow. Since the resources are no longer being depleted the quantity of energy available for work will be considerably increased and swimmers will become capable of far better performances than they were able to achieve earlier in the season.

The timing of the taper is critical. If it is too short, the complete overcompensation effect may not be realized. If it is too long, the super adaptation effect will recede as lack of exercise causes a reversal of the training process and the body's homeostatic mechanisms restore the normal untrained internal environment.

The important questions to be answered concerning the taper are: How long should it last? and How much should the workload be reduced? There are no definitive answers to these questions. They differ according to the race distance, the volume of training that was completed prior to the taper; and the unique physiology of each swimmer. Obviously, the most effective tapers are individualized. However, since most coaches must taper large groups of swimmers, a general framework should be established for the team, with individual variations occurring within that framework. Following are some suggestions for establishing a general framework together with recommendations for individualizing it to meet the requirements of certain swimmers.

General Guidelines for the Taper

The taper should begin 3 weeks before the most important meet of the season, although it may be preceded by a pretaper of 1 to 2 weeks for swimmers who appear excessively fatigued. A pretaper is a period of reduced work that affords excessively fatigued swimmers some additional rest with no loss of conditioning. Daily yardage should be reduced by 1,000 to 2,000 yards/meters during the pretaper. More important, there should be a reduction in training intensity.

The First Week

Each swimmer's state of fatigue should be assessed at the beginning of the first week. Those who do not appear overly fatigued may continue hard training until the next week. Swimmers who, based on previous experience, recover quickly from training, may also wait an extra week before beginning the taper. Those who show signs of excessive fatigue should begin resting during this week. The best sign of excessive fatigue is unusually slow times in meets and practice sessions.

Daily training yardage should be reduced to 3,000 to 5,000 yards/meters for those swimmers who are beginning to taper in this week (3,000 for sprinters and middle-distance swimmers and 5,000 for distance swimmers). The intensity of training is reduced even more drastically. Some anaerobic threshold and $V0_2$ max training is used to maintain aerobic endurance, and sprint training is used to maintain the adaptations of the ATP-CP phase of energy metabolism. These forms of training are not stressful and will maintain training adaptations gained earlier in the season without causing further fatigue.

Stressful drills such as lactate tolerance and race-pace repeats are also reduced to maintenance levels. Two high-intensity training sessions per week should be sufficient to maintain anaerobic training adaptations (Chaplouka and Fox 1975). The distance of each high-intensity set should be reduced from those that were used during the competitive season. Continue with 3 to 5 sessions of sprint training per week but reduce the yardage in these sets to between 400 and 800 yards/meters per session. Swimmers may get tired in their training during this week but they should not be overly fatigued at the end of each practice session. Muscular endurance and power training on land should also be reduced to maintenance levels. Flexibility exercises should be continued throughout the taper period.

Considerable time should be spent practicing starts, turns, relay starts, race-pace, and race strategy. Race-pace is extremely important. Swimmers should be aware not only of the time they hope to swim at the meet but also the splits they must swim to achieve that time. They should enter the competition able to swim repeats within 0.2 to 0.5 of a second of the splits they hope to attain over the first three-quarters of their races.

Stroke drills should be done daily and swimmers should be encouraged to use perfect mechanics. Fatigue may have introduced some faulty mechanics during the competitive season that need to be corrected when the swimmers are resting.

Swimmers should continue to train twice daily if the meet will be swum in preliminary and final heats. By doing so, they can keep their physiological "time

clocks" adjusted to competing twice daily. It is also advisable to train during the same hours the meet will be held. This helps to adjust the physiological "time clock" for maximum effort at the correct time of day. Training twice per day is not necessary if the meet is swum as timed finals or if the taper is for a dual meet.

The Second Week

All swimmers begin tapering at this time even if they are swimming well in meets and practices. However, distance swimmers who are swimming well may taper more gradually. They may begin the week at normal training yardage and decrease that distance by 1,000 to 1,500 yards/meters per day throughout the week. The training pattern should be similar to that described for the first week of the taper.

Those swimmers who have been resting for one week should be evaluated once again. If they appear to be recovering faster than anticipated, add 2,000 to 3,000 yards/meters to their daily training during three days of the week. A small amount of that yardage should be in the form of high-intensity race-pace repeats. Sprinters and middle-distance swimmers who continue to show signs of fatigue should reduce their daily distances by an additional 1,500 to 3,000 yards/meters. These swimmers should reduce the number of high-intensity training sessions to 1 or 2 for the week.

The Final Week

Training yardage should be reduced to 2,000 to 3,000 yards/meters per day for sprinters and middle-distance swimmers, and 4,000 to 5,000 yards per day for distance swimmers. Most of this yardage should be in the form of warm-up swimming and low-intensity anaerobic threshold swimming. Intense training, race-pace swimming, and sprinting should comprise no more than 400 to 1,200 yards/meters during 2 or 3 sessions during the week. All-out sprints should be limited to the 25 and 50 distances since they are not stressful physiologically and recovery is rapid.

The last three days prior to the beginning of the meet are, perhaps, the most crucial of the taper. Swimmers should rest as much as possible during these days so training will not interfere with the super adaptation effects that may be occurring. If the taper has been correct swimmers will not lose conditioning in 3 days of easy swimming. If it has been too long, there is nothing that will remedy the situation during the last 3 days. Therefore, rest is the logical option if you are uncertain about what to do.

Daily yardage is inconsequential during these days, provided, of course, that it is minimal. Begin each session by warming up as you will at the meet. Then, practice stroke drills, starts, turns, and relay starts. Next, practice race pace by swimming a few underdistance repeats. Finish by loosening down for 400 to 500 yards/meters.

Many swimmers make the mistake of sprinting too much during the taper. If sprint training was used throughout the season, rest, rather than additional speed work, will be required during the taper if you expect to produce super adaptations in the energy systems of the muscles that make fast speeds possible. Too much sprinting at this time may delay recovery of the fast twitch muscle fibers, causing sprinters to

enter competition with a reduced metabolic capacity in the fibers they must rely on for energy during their races.

There will be a tendency for body weight to increase during the taper because reduced training requires fewer calories. Swimmers should be advised to reduce their food intake so unnecessary fat is not deposited during these final weeks.

Psychological Factors in the Taper

The success of tapers may stem as much from psychological factors as from those which are physiological in nature. Swimmers must believe they will swim well in order for a taper to have its full effect. Psychological preparation should begin at the first team meeting of the season. The season should be put in perspective by identifying the most important meet or meets and explaining the relative importance of each of the other meets. This will help swimmers maintain their perspective during the season so that their most intense motivation occurs during the taper. This will lead to a psychological as well as a physical peak.

The uncertainties of the taper, particularly whether a swimmer feels he or she is getting too much or too little rest, can create anxieties that may erode confidence. Leading coaches around the world are unanimous in their advice to remain positive during the taper. Athletes need the reassurance that a calm, positive coach can give. This does not mean that a coach should lie to swimmers if the taper is not going as expected. If setbacks make it impossible to honestly indicate that the taper is on schedule, the swimmers should be told so. The environment can then be kept positive by instituting procedures to remedy the situation.

Swimmers should be prepared for any meet conditions that could upset their confidence. Such problems as crowded warm ups, unusually cold or warm water, inadequate wave control, flat turning walls, poor visibility, and unusual starting blocks should be discussed and practice drills instituted to prepare for these conditions. If possible, arrive at the meet site a few days in advance of the competition so swimmers will have time to adjust to these conditions.

The Minor Taper

A minor taper is used to produce fast times in a mid-season meet. It is generally 2 to 3 days in length. Performances are expected to improve during a minor taper although not to the extent that they will improve following a major taper.

There seem to be two methods to achieve a minor taper that are commonly used. In the first method, swimmers reduce their daily yardage drastically for 2 to 3 days before the meet and train as they would during the final 3 days of a major taper. In the second, the daily yardage is reduced only slightly but the intensity of training is decreased until nearly all swimming is at a moderate pace. Both methods have been effective for improving performances and they have the advantage of causing only minimal loss of training time and little or no loss in conditioning.

The Retaper

The first procedure in retapering after a major taper, is to resume training near pretaper training levels. The workout should be sufficiently intense to maintain your present state of condition without causing the fatigue you experienced during the competitive season. This pattern is followed until you are within 3 to 7 days of the next important competition.

It will not be necessary to retaper for the same number of days that were required for a major taper because once swimmers have been fully tapered it will not take so much time to recover during the retaper. If the next meet follows closely, within 1 or 2 weeks, the retaper should be 3 days in length. If the time between meets is greater, the taper period can increase accordingly.

In cases where the performances during the major taper were not as fast as expected, more rest should be given during the retaper. If the next meet is only 1 week away it would be wise to continue resting without returning to hard work. The additional recovery time may correct the situation and produce the desired performances. If the poor performance was caused by too much rest, there is little you can do to correct the situation in 1 week.

When important meets are separated by more than a week it becomes necessary for the coach to make a judgment regarding whether the previous taper has been too long or too short. If you suspect that swimmers have had too much rest and have lost conditioning, work near mid-season levels of distance and intensity until you are within 3 to 4 days of the next meet. If you suspect that they have not had enough rest, maintain a reduced schedule of yardage and intensity similar to that followed in the first and second weeks of a major taper until you are within 5 to 7 days of the next meet. At that time the workload should be reduced and the training should be similar to that followed during the final week of a major taper.