Track Coach

Running Periodization Part 1: Linear Periodization

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Adapted from the book *Running Periodization: Training Theories to Run Faster*

"You can't understand the value of a whole process by separating the parts from the process, or the process from the parts."

In the modern era, most of our understanding of periodization comes from the scientists, training theorists, and coaches of the former Soviet Union, with many of the original modern texts on periodization published in Russian. The scientific rationale for periodization is rooted in Dr. Hans Selye's General Adaptation Syndrome of 1950, and is based on the premise that athletes need to receive an optimal training stimulus that is balanced with appropriate recovery to cause adaptation and favorable long-term training effects. Periodization is thus a blueprint of predetermined sequential periods of focused training that guides the coach and runner in the acquisition of specific characteristics of fitness. It is not a static blueprint, but rather a dynamic one that the coach and runner use to formulate an optimal training program.

While variation is an important factor, periodization is more than simple variation of training stimuli; it's about *how* and *when* training stimuli are varied and *how* and *when* the volume and intensity of training are manipulated throughout the year, always considering the runner's progress and modifying the training accordingly.

Periodization Assumptions

Although periodization is a valuable blueprint to build athletes' training, the theoretical and historical frameworks of periodization are not always in line with biological truths, and we are therefore left with several assumptions.

For starters, periodization assumes that there are established time frames for the development and retention of specific fitness adaptations and that biological adaptation to a given training plan follows a predictable course. However, as any coach who has been coaching for a while knows, not every runner adapts or progresses at the same rate or to the same extent. Indeed, individual runners often

respond differently from one another, even with identical workouts and training programs. Research has also shown a lot of variability in the response to both cardiovascular and strength training."

That leads us to the second assumption, that training plans, training phase duration, and rates of progression can be generalized among the population, or that the training of elite runners, who are, by definition, extreme outliers, can be generalized and extrapolated to other elite runners or to less talented runners. Although the training of elite runners is often celebrated and admired, we actually don't learn much from studying how elite athletes train, because their results are more a product of their extreme talent (both their latent talent and their talented responsiveness to training) than of their specific training.

A third assumption of periodization is that various fitness attributes are best developed in a sequential way (e.g., strength before power or endurance before speed). And fourth is the assumption that training can be adequately forecast, that we can predict what's going to happen later so that we can plan for it now.

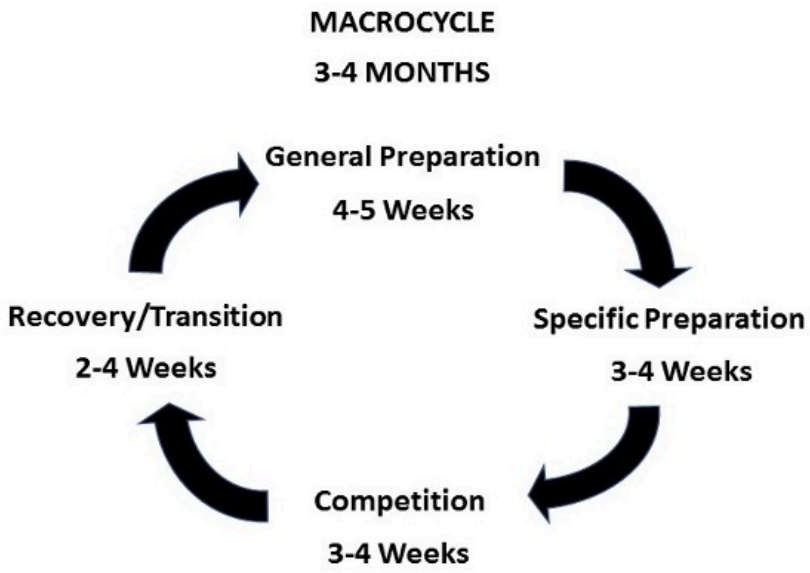
One of the reasons these assumptions exist is that periodization is a difficult thing to study scientifically, mostly because it's difficult to use the scientific method to test whether or not one method of training is better than another method of training. Scientists like to (and need to) control (independent) variables to isolate the (dependent) variable that they're trying to study. Variables that get in the way are called confounding variables for a reason—they confound the results.

If two people (or 20 people in each of two groups) train differently—person A (or group A) trains in a periodized way and person B (or group B) trains in a nonperiodized way, or they train in *different* periodized ways—and, six months later, person A (or group A) runs one mile or 5K faster than person B (or group B), can we say that the better race performance was *because* of the periodized training? Can we conclude that periodized training is better than nonperiodized training? What if we tried a repeated measures study design, in which a periodized training plan and a nonperiodized training plan (or two different kinds of periodized plans) are both given to one group of 20 runners in random order, with ten runners given plan A first and ten others given plan B first (which, statistically speaking, is a more powerful study design than an independent groups design). Can we then determine which training plan is better? How do we account for the cumulative effect of training and the effect of initial training on later training and on race results? How do we know that a runner's race performance is the result of his or her training in the six months leading up to that race, rather than the result of the previous six months of training? These are difficult questions for science to definitively answer.

Before we discuss the different periodization models, it's helpful to review how the pieces of training are put together in a periodized plan.

Macrocycles

Periodization divides a year of training into major periods called *macrocycles*, which are about three to four months and most often comprise a single competitive season (e.g., a cross-country season or track and field season for a high school or college runner). In endurance sports like distance running, macrocycles are typically pieced together to create an annual cycle (which can be shorter than one year for less experienced/recreational runners), while shorter periods than a year are used for strength/speed/power sports. The training of elite athletes can also be planned with larger cycles, like four-year Olympic cycles or, similarly for serious high school and college runners, four-year school cycles.



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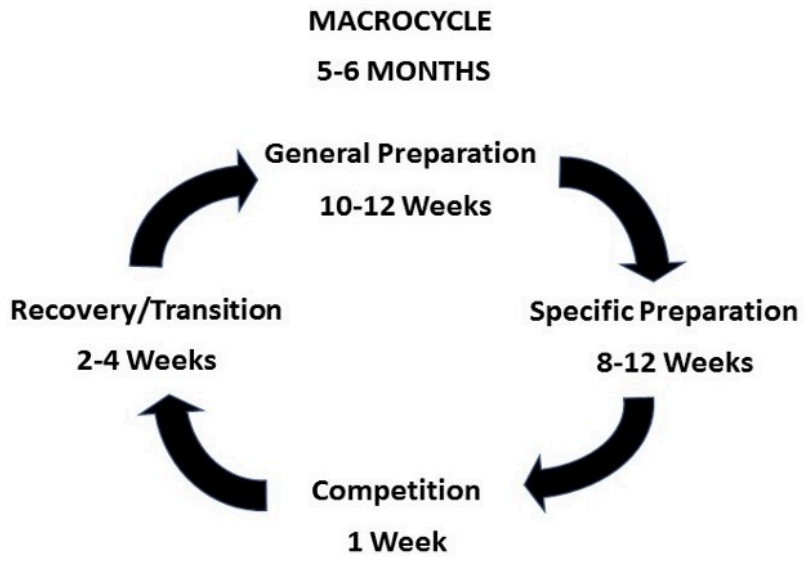

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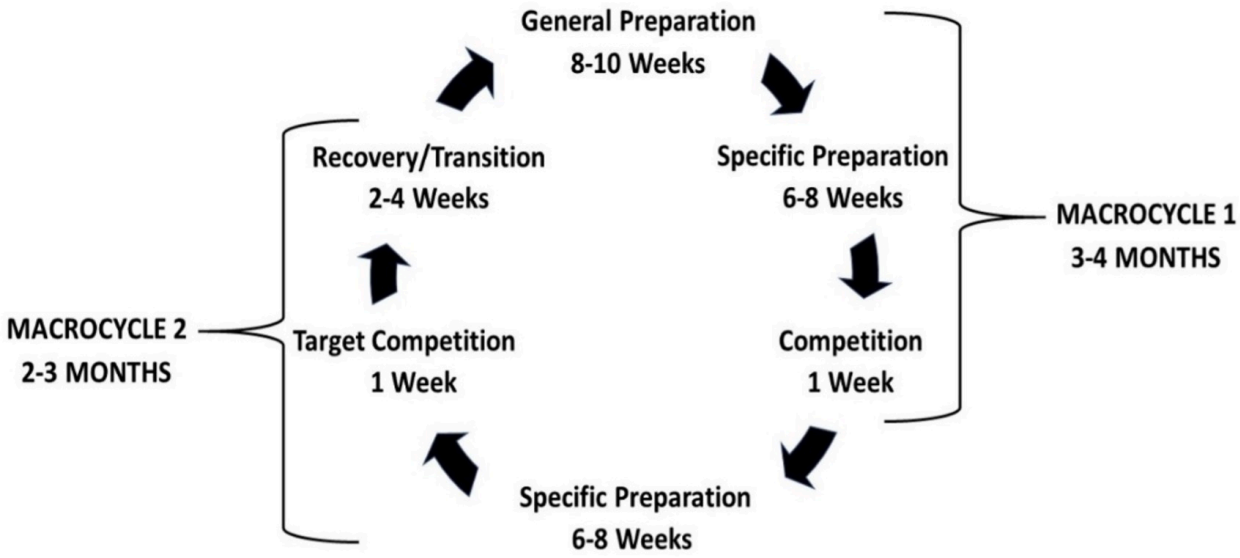
content/uploads/2022/08/Macrocycle2.jpg) *Periodization Phases for One Target Race*

Within each macrocycle is a *preparatory phase*, which is sometimes further divided into *general* and *specific preparatory phases*, a *competitive phase* that develops the specific competitive sport skills while maintaining the general physical performance achieved from the preparatory phase, and a *transition phase* of two to four weeks that serves as a recovery between macrocycles. The preparatory phase contains general, high-volume, low-intensity training to develop aerobic, cardiovascular, and metabolic characteristics and structural integrity, and the competitive phase contains specialized, high-intensity, low-volume training and races to develop anaerobic characteristics and the specific skills needed to race.

For runners who train for one target race, rather than plan the training for multiple seasons of racing with multiple races at the end of each season, it's better to either lengthen the duration of the three- to four-month macrocycle with longer general and specific preparation phases and a short (one week) competition phase, or piece two or three macrocycles together with shortened one-week competition phases for benchmark races leading up to the target race and eliminating the recovery/transition phase until after the target race.



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Periodization Phases for One Target Race (2 Macrocycles)

Mesocycles

Macrocycles are divided into medium-size *mesocycles*, which typically last three to six weeks. Each mesocycle has a theme, with one or two training objectives, or targets. The mesocycle is the "scene" of the training program. Like the director of a movie,

the coach decides on the theme of the scene to meet the overall fitness objectives. As fitness improves, each successive mesocycle should involve average greater training loads than the cycle just completed.

Regardless of the race distance for which your athletes are training, the initial mesocycles are similar because the purpose is similar—to increase aerobic capacity. The differences lie in how high the weekly volume gets and how much time you devote to the development of aerobic capacity, with longer races like the half-marathon and marathon requiring higher volume and more time on the aerobic component than shorter races like 800 meters, 1,500 meters/mile, and 5K. However, these differences are not as major as you might think since all races that take longer than two minutes are more aerobic than anaerobic, so even training for a one-mile race requires a lot of aerobic training. The major differences in the training program come later, as paths diverge through the specific preparation and competition phases.

Microcycles

Within each mesocycle are several (3 to 6) smaller periods called *microcycles*, which are typically one week. It's likely that seven days is used to align with the weekly calendar rather than because that is the optimal time for adaptation and the repetition of a specific stressor. There doesn't seem to be anything magical or scientific about seven days. Microcycles could last longer, like 10 to 14 days, depending on their objectives, the runner's time frame for adaptation, and the amount of time needed for recovery between workouts.

The microcycle is the "working unit" of the training program. Every microcycle should have its own specific objectives, which are integrated with the objective of the entire mesocycle. Like the movie director, the coach directs the training and prescribes the specific work based on the theme of the scene.

- Think of the training cycles as a house.
- The macrocycle is the fully-constructed house.
- The mesocycles are the rooms of the house.
- The microcycles are the furniture in each room.

One macrocycle (house) has 2 to 5 mesocycles (rooms) that have 3 to 6 microcycles (furniture) in each.

Now, let's take a look at the different models of periodization. Because there is not just one way to build the house.

Linear Periodization

The traditional periodization model of training that many elite runners and coaches have adopted and that has trickled down to nonelite runners is rooted in Soviet Union training theory, which was based on the premise that general (aerobic endurance) training should precede specific (anaerobic speed) training, in part because it was believed that a well-developed foundation of endurance, achieved by high-volume/low-intensity training, is crucial to tolerate and respond optimally to an increase in training intensity. Thus, the traditional model of periodization begins with a steady increase in low-intensity volume and, as training progresses throughout a macrocycle, initial mesocycles are of higher volume and lower intensity and later mesocycles are of higher intensity and lower volume. This model of periodization is called *linear periodization* because there is a decrease in volume and matched increase in intensity over time. In reality, linear periodization should be called *curvilinear periodization*, since the changes in both volume and intensity are not (and should not be) linear.

Linear periodization is largely theoretical and traditional in nature, validated only by athletes' success. Controlled studies on the physiological and performance results of long-term linear periodization, especially on distance running performance, and studies comparing the effects of linear periodization to other types of periodization, are scarce.

It seems to me that linear periodization, progressing from high volume/low intensity to low volume/high intensity, makes sense for shorter races, from 800 meters to 5K. The end of the macrocycle includes the highest intensity of training and most closely matches the intensity of the upcoming races, which means that your athletes are doing the most race-specific work as they get closer to the races.

General Preparation Phase

During the general preparation phase of a linear periodization program, the initial emphasis is on general endurance by building up the weekly volume. The intensity of daily runs should be low, about 70 to 80 percent max heart rate (65 to 70 percent VO_2max) for 30 minutes to about 90 minutes (longer if training for a half-marathon or marathon). Runs should feel gentle and should build your athletes up rather than tear them down. It's easy in this phase to run too fast, in part because there are no hard workouts tomorrow for which your athletes need to be ready. But this phase is not about pushing the pace. Runners must be disciplined to run easy, and to accumulate more and more easy running over time.

When increasing volume, first increase the duration of each run. Longer single runs build endurance. If your athletes run less than 40 to 50 miles per week, it's better to run just once per day. If their runs reach an average of exceeding an hour per day,

increase their volume by running twice per day a couple of times per week. Double runs enable your athletes to increase their training load while minimizing stress. With two runs, they also get two hormonal responses and thus two opportunities for adaptation, because they have more frequent signals for protein synthesis.

Among elite endurance athletes (and presumably also for everyone else), a large training volume during the general preparation phase appears to be an important characteristic for exceptional athletic performance several months later, although it is not clear why. There is very little documentation regarding the correlation between training in the preparation phase and physiological capacity or performance in the competition phase months later. Scientific studies always test subjects immediately prior to, during, and immediately after a training intervention, not again months later. As mentioned previously, one of the assumptions of periodization is that it can predict future responses from the training your athletes do now.

Specific Preparation Phase

The weekly running volume continues to increase through the specific preparation phase of the linear periodization program, as your athletes focus on specific quality endurance, with fartleks and threshold runs to raise their acidosis threshold, which train their ability to hold a faster aerobic pace. Easy runs should continue in this phase as you add one to two threshold workouts per week. These workouts can be continuous threshold runs, interval workouts, or fartleks.

The next part of the specific endurance phase includes aerobic power (VO_2max) training, through the use of interval workouts that train the cardiovascular system's ability to deliver oxygen to the working muscles. The cardiovascular adaptations associated with interval training, including hypertrophy of the heart's left ventricle and a greater maximum stroke volume and cardiac output, increase your athletes' VO_2max, raising their aerobic ceiling. Cardiac performance is a primary determinant of VO_2max. In comparison to acidosis threshold training, which is mostly about what's happening in the runner's legs, the site of adaptation of VO_2max training moves from the skeletal muscles to the cardiovascular system. Thus, the most powerful stimulus for change in cardiac function (VO_2max) is different from the most powerful stimulus for change in skeletal muscle aerobic capacity (acidosis threshold). This is one of the reasons why improvement in VO_2max takes less time (weeks to months) than improvement in the acidosis threshold (months to years).

For most runners who train for 5K, 10K, half-marathon, and marathon, threshold training and VO_2max training, together with continued high-volume/low-intensity training that improves running economy, are enough for the specific preparation phase, since those races are most influenced by those physiological factors. For

runners training for middle-distance races (800 meters to 3,200 meters), some anaerobic capacity training that targets anaerobic glycolysis (speed endurance) should also be included in this phase.

Competition Phase

During the competition phase, the training transitions from aerobic metabolic and cardiovascular work to anaerobic metabolic and muscular work, with anaerobic capacity (speed endurance) and races taking center stage. Weekly volume begins to decrease as intensity increases.

Of the first three phases, the competition phase is the most varied between runners. For example, a high school track runner may have a series of important short races (from 800 meters to 3,200 meters) in the span of one month, while a marathon runner may have one important long race on one day. The number and duration of these races will dictate exactly what training is done in the competition phase. An 800-meter runner and miler will do a considerable amount of anaerobic speedwork, while a marathon runner will spend more time developing him- or herself aerobically and doing more race-specific endurance training.

Recovery/Transition Phase

Runners would love to run at their peak all year round. However, physiological peaks are rather fleeting and, after they occur, continuing to train with more volume and intensity doesn't do any good; it's better to work in peaks and valleys. So it's important to come off that peak and recover: that enables the athlete to train to reach a higher peak later in the year. Thus, the final phase of a linear periodization training program is recovery/transition, during which your athletes recover from the previous training and racing and get ready, both physically and psychologically, for the beginning of a new macrocycle. This phase includes a combination of complete rest, cross-training, and perhaps some very easy, short runs. In general, the longer the preceding buildup (macrocycle), the higher the volume, and the longer the targeted race just completed, the longer the recovery/transition phase.

Part 2 of this series on periodization will discuss reverse linear periodization.

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