Playing with Science

Research tells us that periodization is the best approach to designing strength programs. Applying it in sport-specific situations, though, takes a little experimenting.

By John Cissik, Michael Barnes, & Allen Hedrick

*John Cissik, MBA, MS, CSCS*D, NSCA-CPT*D, is the Director of Fitness and Recreation at Texas Woman's University. Michael Barnes, MEd, CSCS*D, NSCA-CPT, is a former strength coach for USA Rugby and the San Francisco 49ers. Allen Hedrick, MA, CSCS*D, is the Head Strength and Conditioning Coach at the NSCA's national headquarters and former Head Strength and Conditioning Coach at the U.S. Air Force Academy. All three have authored numerous articles and presented on many topics in strength and conditioning.*

When an athlete's goal is to maximize increases in strength, power, or muscular endurance, a strength and conditioning program based on periodization is widely accepted as the most effective approach. For more than two decades, whether they are training football players or gymnasts, most strength coaches have followed this model.

However, what is easily forgotten is that periodization is not an exact science. There are enough studies published to let us know that the method works, but there is actually not a lot of data on how to maximize its effectiveness for collegiate and high school athletes in specific situations.

Because of this, it's necessary to use periodization in a flexible way and to continually experiment with it. We've seen coaches dogmatically follow a periodization model regardless of the athlete's situation or needs, and then become frustrated when no gains are made. Periodization is a roadmap to guide us, but we must learn how to choose the correct paths within it.

A QUICK REVIEW

The overall goal of periodization is to bring athletes to a physical peak for their most important competition(s). It also prevents injuries stemming from overtraining and maximizes variation in the training program to ensure optimal physiological adaptations. Periodization generally involves organizing the year into periods, each with a specific focus or goal. Various periodization models may have different names for their organizational structures, but all have the following in common:

Off-season: The off-season lays the foundation in terms of muscle size, strength, endurance, and technique. The volume of work is higher than in later phases, while intensity is lower. Exercise selection tends to be general in nature.

Preseason: During the preseason, the base fitness developed in the off-season is applied to the sport. The intensity is higher than in the off-season and volume is lower. Exercise selection becomes more specific to the needs of the sport.

In-season: This is when the physiological peak should occur. For some teams, this is the most intense training phase of the year. But for teams that focus on sport training and competition during this time period, it is a maintenance phase.

Postseason: The postseason follows the final competition and is a rest and recovery phase. It generally lasts for two or more weeks and consists of unstructured training designed to give the athlete a chance to mentally and physically recover from the rigors of competition.

RESEARCH ON PERIODIZATION

Research into the effectiveness of periodization in the United States has been evolving over the last 25

years. But while studies have shed light on many aspects of this training model, there are some clear limitations to the research, especially for strength coaches working in a traditional high school or college setting.

To start, the research rarely uses athletes as subjects. Since most researchers work in universities, they generally enlist college students enrolled in weight training classes for their studies. This creates a challenge because highly trained athletes are different from college students enrolled in activity classes. In general, athletes have a higher fitness level, greater training experience, different motivations, and different innate capabilities. All of this means that students enrolled in a physical education course will experience training differently than a competitive athlete.

The second problem is that the research is rarely long enough to elicit long-term training effects. Most studies last for an academic semester. However, athletes do not train for one semester—they train over a period of months and years. A training protocol that is effective for a semester may or may not continue to work over a longer period of time. This makes it difficult to compare a training program that lasts for six to 12 weeks to a program that is supposed to work for four to five years.

A third limitation arises from the modes of exercise used in the studies. Most periodization research focuses strictly on strength training and does not use multiple modes of exercise. However, athletes use more than strength training in their conditioning programs. They may sprint, perform agility drills, engage in core work, and perform mobility training. All of these activities present different stresses to the body and each interacts with the others. Failing to study periodization using multiple modes of exercise creates an extremely incomplete picture of how to train athletes.

Because periodization studies do not simulate athletic situations, how does a coach apply the method scientifically to his or her program? Most important, one must be cautious of employing "cookie cutter" periodization programs. In other words, you cannot take a standard periodization model and apply it directly to all athletes. You should use the method as a starting point, and then assess and explore the nuances of it as you train your specific athletes. You can accomplish this through goals and measurements, experimenting, and knowing how to apply advanced concepts.

GOALS & MEASUREMENTS

The ultimate measure of the success of a strength and conditioning program is whether it produces quantifiable results. Thus, it is important to test and monitor on a consistent basis. Most coaches pre-test their athletes and then test them again at the end of the training cycle to determine whether the training program worked. However, athletes should also be monitored on a more frequent basis to assess if the training program, and the specific periodization scheme, is working.

There are numerous tests that can be used to measure enhancement of physical performance capabilities, including vertical jump, body fat, squat, pro-agility test, and VO2 max for aerobic fitness, to name just a few. It is important to align testing with characteristics of success in the athlete's position in his or her particular sport. A good rule of thumb is to perform these tests every four to eight weeks.

It is recommended that coaches meet with each athlete to determine realistic short- and long-term goals. There is a great deal of information to be gleaned from these meetings. For instance, you may find that the athlete's expectations are unrealistic, or that they have goals you weren't aware of. Ultimately the goals should be high but attainable—and completely understood by the athlete.

To ensure that the program is working toward those goals, it is important that you record information about the athlete throughout training. Ideally, you should save data from each training and testing session, because this will allow you to evaluate changes in performance capabilities. You may find that within a training cycle the athlete is not improving and you need to change tactics. Without compiling the data, it would be hard to know this.

Also understand that athletes may respond differently to the same program because of variables like training status, age, genetics, diet, environmental and emotional stress, or even reasons we are not yet aware of. Because the research is not there, we need to continually assess the program for our individual athletes.

KEEP EXPERIMENTING

When measurements and observation reveal that the program is not working as well as it should, coaches should start experimenting with different tactics. For example, we have found that the standard periodization model does not often translate well to sprinters and jumpers in track and field. In response, we have experimented with a different format for these athletes. We started by listing those principles of sprinters and jumpers that require deviation from many traditional periodization approaches:

Not everyone needs bigger muscles. Track and field athletes have to be able to perform with their body weight. Putting too much extra muscle mass on them can affect performance in unintended ways. This means that the first eight to 16 weeks of the training year do not necessarily need to be spent on the hypertrophy training called for by many traditional periodization models.

Sprinters and jumpers need to be explosive year round. Track and field athletes need to perform explosive training year-round so that they can mentally transfer the weight room to their event. For example, the variations of the Olympic-style lifts should form the foundation of the training of sprinters and jumpers year-round.

Strength affects speed and explosiveness. Improving strength will improve speed and explosiveness in track and field. Therefore, at least some strength work should be done year-round.

Heavy weeks are too fatiguing. Traditional heavy weeks of training (e.g., weeks of 90 percent intensity or above) have a tendency to break down many sprinters and jumpers, making their event practice and performance suffer. One solution is to make every Monday a heavy day so that the athletes focus on maximal strength on that day. The rest of the week is divided between lighter explosive and restorative-type training as needed.

Link event training with strength training. The same qualities and energy systems should be trained in the weightroom and on the track or field on the same day. This helps the athlete mentally link the two and allows them to recover better between training sessions. For example, if Tuesday involves acceleration work on the track and Wednesday involves heavy Olympic-style lifts, then the athlete has trained short-burst explosiveness (and the phosphagen energy system) two days in a row. Instead, it's better for the athlete to perform both on Tuesday, which allows for nervous system and energy system recovery on Wednesday.

With this information, we can develop a game plan for how to tweak the traditional periodization scheme to make it work for the track and field athlete. We have found it beneficial to chart each phase with the categories of duration, goals, exercises, and volume and intensity. (See *A Model for Sprinters*.)

ADVANCED CONCEPTS

Because we don't have research on how the periodization model works with high-level athletes, it is hard to know when or how to alter the program. We do know, however, that many athletes reach plateaus in their training as they advance. In response, many strength coaches feel that as athletes progress closer to their genetic potential, there is a greater need for variation in their programs.

This can be accomplished in the strength and conditioning program by manipulating the program design variables: volume, intensity, training density, and exercise selection. You may also want to consider the following strength and conditioning methods that vary from a traditional progressive overload:

Conjugated Methods: This includes the integration of a strength exercise with an explosive movement. Also called "postactivation potentiation," the theory is that one exercise will enhance or activate the other. An example would be a back squat used in conjunction with box jumps. Because of physiological mechanisms, postactivation potentiation occurs most notably in fast twitch (type II) muscle fibers. This correlates nicely with developing strength and power characteristics.

Summated Microcycles: This model groups together four weeks of training. In the first three weeks, the workload is progressively increased. In the fourth week, the workload is reduced considerably to provide for recovery. Four of these training blocks can then be grouped together to "summate" a four-month training cycle. This training model decreases the potential for overtraining while allowing for the reintroduction of specific stimuli at regular cyclic intervals.

Concentrated Loading: The idea here is to follow a planned systematic loading scheme in which a period of large volume and intensity is followed by a period of reduced volume and intensity. The theory is that this type of loading scheme results in significant improvements in performance after the athlete recovers. Overreaching is a form of concentrated loading in which the athlete attempts to achieve large gains in a short period of time, after which reduced training occurs.

To be a successful strength and conditioning coach, you need to understand the foundations of exercise science and their application, and be willing to dig for research, analyze it, and apply it to your situation. However, you also need to be flexible enough to understand that science has limitations and adjust accordingly. Working with periodization provides a prime opportunity to learn how to do just that.