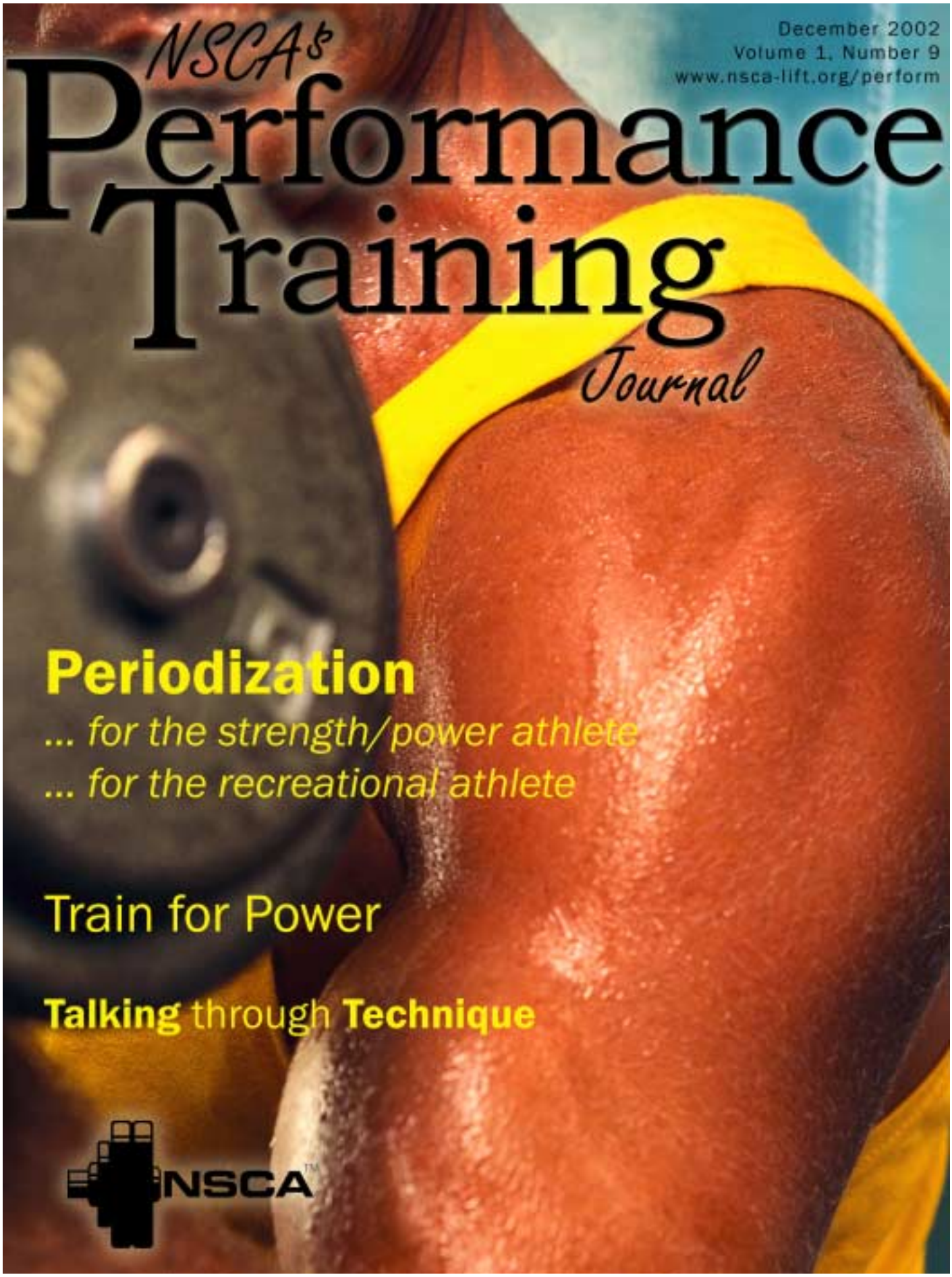

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NSCA's

# Performance Training Journal

## Periodization

*... for the strength/power athlete*

*... for the recreational athlete*

Train for Power

**Talking** through **Technique**

NSCA™

*NSCA's Performance Training Journal*
www.nsca-lift.org/perform

Volume 1, Number 9

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NSCA's Performance Training Journal

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## Mission

As the worldwide authority on strength and conditioning, we support and disseminate research-based knowledge and its practical application to improve athletic performance and fitness.

# TalkToUs

Share your questions and comments. We want to hear from you. We will choose one question each month for the "Ask the Experts" column. Write to Performance Training Editor, NSCA, 1955 North Union Blvd., Colorado Springs, CO 80909 or send email to kcinea@nsca-lift.org.

Suzie Tuffey Riewald, PhD, NSCA–CPT

# Talking through Technique

Drill, drill, drill . . . As a swimmer, you know how critical effective, efficient technique is to performance — to fast swimming. Doing stroke drills where one practices a specific element of technique is the primary way swimmers work on improving technique. For example, stroke drills can focus on the "catch" in freestyle, body rotation in backstroke and freestyle, or controlling undulation in butterfly.

If you're like most swimmers, you get through a few 100 meters of stroke work in a training session then get on with the "real" workout—the test set or intervals. When all is said and done, the time that is spent on developing stroke technique probably makes up only a small portion of your total practice time. Rather than only focusing on technique during stroke drill sets, let's look at how you can use mental skills to enhance swimming technique (or technique in any other sport, for that matter) throughout a training session. Specifically, purposeful self-talk is a skill that can be used to enhance your technique — which will, in turn, enhance your performance. [Refer to volume 1 issue 4 for detailed information on self-talk.]

To convince you of the value of integrating purposeful self-talk into stroke drills and swim training, let me describe a project we conducted at USA Swimming. We invited a group of local age group swimmers to swim in the flume. (The flume is like a water treadmill in that a person swims against an adjustable current; the athlete stays in the same place and can therefore be filmed from front and side angles. See figure 1.) We filmed athletes as they swam their stroke of choice at a given pace. Their coach was asked to observe athletes swimming and identify one aspect of his/ her stroke that the athlete needs to work on to try to improve. The coach provided specific "technical cue words" to each athlete that would serve as the cue telling them what they need to do. For example, a breast-stroker was told to use the cue "snap the legs"; another athlete was told to "roll the body" more in freestyle.

The athletes were then asked to swim the same stroke again, but, this time, to use the technical cue words in an effort to enhance their swimming technique. This, too, was filmed. We finished the project with two video clips of each athlete — one with the athlete "just swimming" and the other with the athlete swimming while using his/her individualized technical self-talk cue. A group of coaches were later shown the clips and asked to identify in which clip, if either, each athlete swam more efficiently—with better technique. There wasn't a doubt! It was obvious to the naked eye that when the athlete used purposeful, technique-related self-talk it had a positive impact on technique in the water.

Now to you . . .what does this mean to you and your swimming? Whether you swim 1000m or 5000m a day, you can benefit from incorporating self-talk (i.e., technical cue words) into your training to enhance your swimming technique — and ultimately your swimming performance. Take the following steps to get started:

1. Identify elements of your stroke that you need to work on/ modify to enhance your swimming efficiency.
2. Identify the technical cue words that "speak to you"; that will tell you what you need to do to improve your technique. Maybe it is a description you picked up from a coach or words that describe how it should feel or look.
3. Purposefully integrate this self-talk into your swim training — allocate time during warm up, during stroke drills, and/ or during hard training efforts. A word of caution — KISS: Keep in Simple, Swimmer. Work on one or two elements of your technique at a time; avoid overwhelming yourself with cues for each and every aspect of technique.

**Figure 1: The flume at USA Swimming headquarters**

## About the Author

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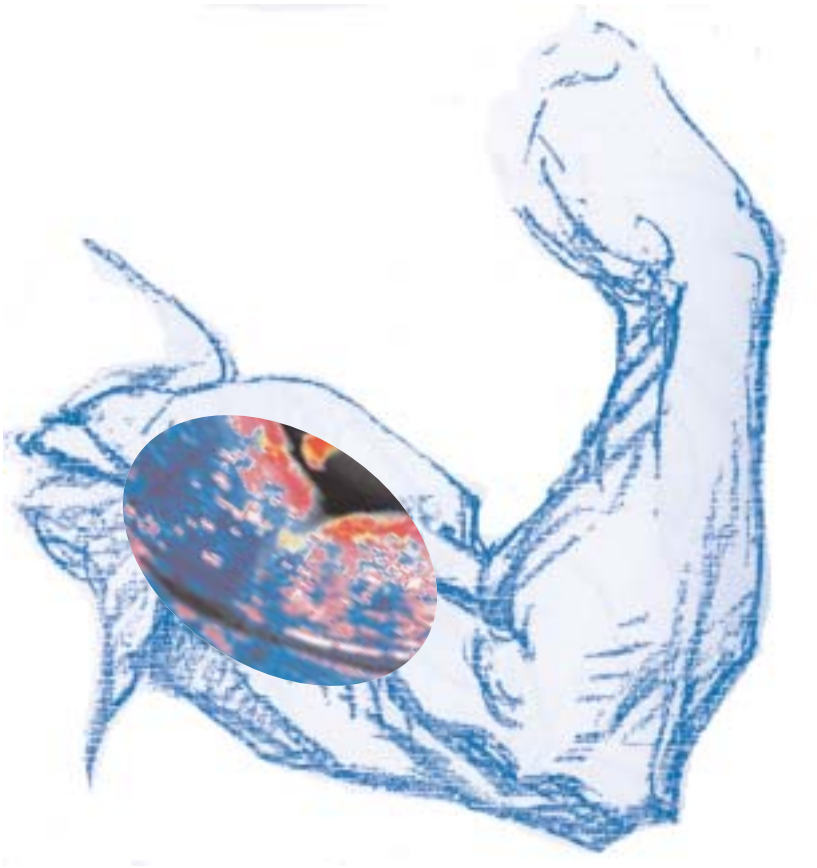
Lee E. Brown, EdD, EPC, CSCS,*D

# Muscle Fuel



In order for a muscle to contract, it must have a ready fuel supply. This is best accomplished through the transfer of fuel from oxygen that is transported to the muscle through the bloodstream. The primary fuel for all muscle contraction is adenosine triphosphate or simply ATP1. There are three main ways that fuel is transported to the muscle and they are derived through the use of a timing or intensity system. How hard and how quickly you ask the muscle to contract will determine which fuel source is utilized.

## Phosphagen System

This system provides fuel for primarily short duration, high intensity exercise [4]. However, this system is active at the beginning of all exercise regardless of intensity. It works by combining ATP and creatine, which are stored in the muscle, to produce energy for muscle contraction. Yet, since the stored amounts are so low in the muscle (generally highest in fast twitch muscle fibers) this fuel source may only last as long as 10–20 seconds[2]. Requiring no oxygen for delivery, this is the primary fuel source for heavy resistance training[5].

## Glycolysis System

This is the breakdown of carbohydrates for fuel which is either stored in the muscle as glycogen or is delivered to the muscle in the blood stream as glucose[1]. There are two main forms of glycolysis, fast and slow[3]. Fast glycolysis is used for times when oxygen is in short supply. Fast glycolysis results in the formation of lactic acid, the byproduct of energy supply to the muscle[4]. An increase in lactic acid in the muscle can involve muscular fatigue and ultimately cessation of exercise. Slow glycolysis is used if there is enough oxygen to allow a continuous supply of fuel. The byproduct of this form of glycolysis is pyruvate, which is not converted to lactic acid but is transported elsewhere. The end result of these two systems is that glycolysis can produce fuel for 30 seconds to a minute for moderate heavy resistance training. If continued, lactic acid would result in muscular fatigue and ultimate stoppage of the exercise[5].

## Oxidative System

This system is often referred to as the aerobic system. As you might expect, this fuel supply offers energy to the muscle through the use of continuous oxygen transport. This system works at rest and during very low intensity exercise such as repeated repetitions during resistance training for walking or running 1. This form of energy primarily utilizes fats (70%) and carbohydrates (30%) as fuel sources, but as intensity is increased there is a switch in substrate majority from fats to carbohydrates3.

Glucose and glycogen are used when oxygen is present in large quantities. Enzymes can break down fats stored in cells, which can be used as a fuel source. Protein is not a significant source of fuel for muscle contraction but it can be broken down into branched chain amino acids and converted to energy. The oxidative system usually supplies energy for low intensity exercise lasting up to one and a half hours.

## Summary

While all three energy systems (phosphagen, glycolysis, and oxidative) are active all the time, which system provides the majority of energy will be determined by a time based and intensity based process. Phosphagen is primarily used for 10–20 seconds, glycolysis for up to a minute, and oxidative is the primary system for all long-term exercise. For the most part, each system uses a different fuel and is specific to the relative intensity of the exercise session, with phosphagen being high intensity, glycolysis being moderate intensity, and oxidative being low intensity.

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# Periodized Training for the Strength/Power Athlete

Jay R. Hoffman, PhD, FACSM, CSCS *D

The use of periodized training has been reported to go back as far as the ancient Olympic games. Its basic premise is that through manipulating training volume and intensity, in conjunction with appropriately timed short unloading phases, the athlete can reach peak condition at the appropriate time, and minimize the risk for overtraining. This article will address the background of periodization, its efficacy and various models of periodized training, with the primary emphasis on the strength/power athlete.

## Basic Principles of Periodization

The basic principle of periodization is a shift from an emphasis of high volume (exercises x sets x repetitions) and low intensity (% of maximum effort) training to low volume and high intensity training. The training year is divided into distinct phases known as mesocycles. Each mesocycle relates to a change in the volume and intensity of training, and may last for 2 – 3 months depending upon the athlete. Typically each mesocycle reflects a specific training emphasis for that phase of training.

The initial mesocycle is called the preparatory or hypertrophy phase and consists of high volume and low intensity training. It is designed to primarily increase muscle mass and muscle endurance, and to prepare the athlete for more advanced training during the later stages of training. The next two mesocycles are generally referred to as the strength and strength/power phases, respectively. In these mesocycles training intensity increases while training volume is reduced.The final mesocycle of the training year is the peaking phase. During this training phase the athlete prepares for a single contest by further reducing training volume and increasing intensity.

It is not uncommon to have short training cycles called microcycles that help transition from mesocycle to mesocycle. These microcycles are generally 1 – 2 weeks in duration and provide a change to the normal training routine allowing the athletes to avoid staleness and aid in recovery. Table 1 provides an example of training manipulations across the various mesocycles in the strength/power athlete.

| Mesocycle | Sets | Repetitions | % 1-RM |
|---|---|---|---|
| **Hypertrophy** | 3 – 5 | 8 – 12 | 60 – 75% |
| **Strength** | 3 – 5 | 6 – 8 | 80 – 85% |
| **Strength/Power** | 3 – 5 | 4 – 6 | 85 – 90% |
| **Peaking** | 3 – 5 | 2 – 4 | >90% |

**Table 1: Volume and intensity in a periodized strength training program**

In athletes that participate in a sport placing importance on an entire season (i.e. football, basketball), peak condition needs to be achieved by the onset of the competitive year, and maintained throughout the duration of the season. These athletes generally have a short peaking phase preceding training camp or the start of the season. However, during the season both training intensity and volume are manipulated to reflect the importance that is placed on practicing sport specific skills. During this training phase exercise intensity is reduced to levels similar to those used during the strength phase, while training volume is lowered by reducing the number of assistance exercises. Inseason training is typically called the maintenance phase and is generally performed at a reduced frequency of training as well.

## Efficacy of Periodization

Increases in strength have been shown in both periodized and nonperiodized resistance training programs. However, strength improvements do appear to be greater as a result of periodized training[3]. The upper range for strength improvement in the 1RM bench press is reported to be about 17% in nonperiodized training programs and 29% in periodized training programs, while the upper range for 1RM squat is 32% in nonperiodized and 48% in periodized training[1,4,6,7,8]. In addition, periodized resistance training programs appear to be superior than nonperiodized training programs in generating improvements in vertical jump performance[5,6].

These studies provide evidence that periodized resistance training is more effective than nonperiodized training in eliciting strength and motor performance improvements. However, this advantage may be largely dependent upon the training status of the individual[2]. The magnitude and rate of strength increases are much greater in untrained individuals than in trained individuals, therefore in consideration of the rapid strength increases seen in novice lifters, periodized training may not be necessary until a certain strength base has been established.

## Models of Periodization

The periodization model that has been the focus of discussion until now consists of uniform changes in training intensity and volume that remain relatively constant throughout each mesocycle. This linear model of periodized training is the classic form for designing most periodized training programs. However, nonlinear or undulating periodization models are also becoming popular. This model of periodization varies the volume and intensity of training from workout to workout (see Table 2). Light, moderate and heavy intensities of training can be alternated during each week of training. Nonlinear training appears to be as effective as traditional or linear models of periodization. In sports that have several games or competitions in a given week, nonlinear training may be preferable to use because of the ability to use relatively light training intensities on days proceeding or on days of competition. High intensity training will still be used, but at a more appropriate time of the week.

The following are examples of periodized training programs for a strength/power athlete playing a team sport, and a strength/power athlete involved in a sport placing primary importance on an isolated competition (i.e. National meet) during the training year. Each program should be considered as only an example and a possible guideline in developing a periodized training program to meet your needs or the needs of your athletes. It is important to remember that the entire athletic conditioning program needs to be considered during the development of the periodization program, and not just the resistance training component of the program.

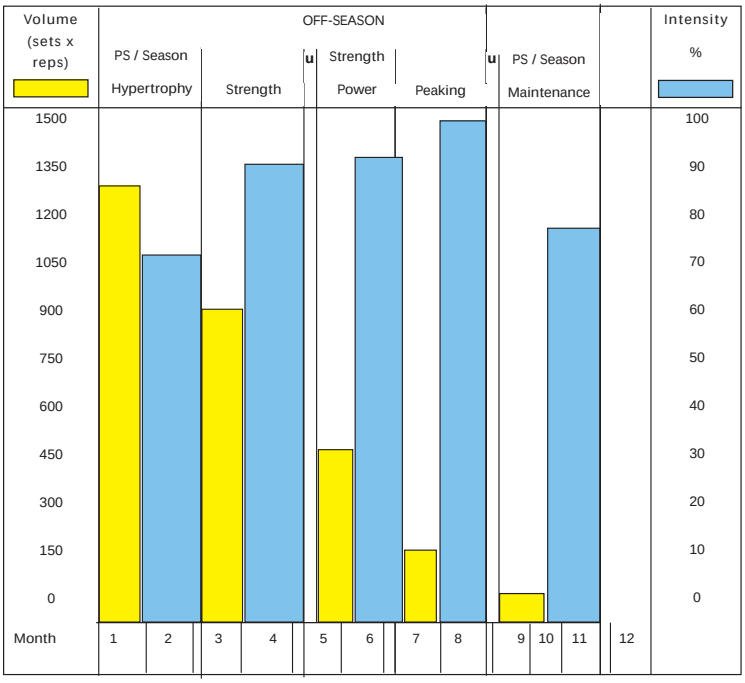
## Periodized Training Program for a Strength/Power Athlete in a Team Sport

An example of an annual periodized training program for a strength/power athlete playing a team sport (i.e. football) can be seen in **Figure 1.** The initial mesocycle is the preparatory or hypertrophy period in which the primary objective of the resistance training program is to prepare the athlete for more strenuous training that will be experienced in the subsequent training phases. In addition, the intensity and volume of training during this phase will also be conducive for those athletes needing to add additional muscle mass. During this training phase the athlete may also perform some additional form of conditioning

**Table 2: The linear model of periodized training**

| | Sets | Repetitions | Rest Between Sets | Training Goal |
|---|---|---|---|---|
| **Day 1** | 3 – 5 | 8 – 10 RM | 2 min | Strength |
| **Day 2** | 4– 5 | 3 – 5 RM | 3 – 4 min | Strength/ power |
| **Day 2** | 3 – 4 | 12 – 15 | 1 min | Hypertrophy |

**Figure 1: An annual periodized training program for a strength/power athlete playing for a team sport.**




This program assumes that there is no spring football.

u = unloading week

PS = Preseason

activity (i.e., jogging, cycling, swimming, recreational sport) 2 - 3 days per week to maintain their cardiovascular endurance. At the conclusion of this mesocycle there may be an unloading phase that significantly reduces the intensity and volume of training to prepare the body for the next phase of training.

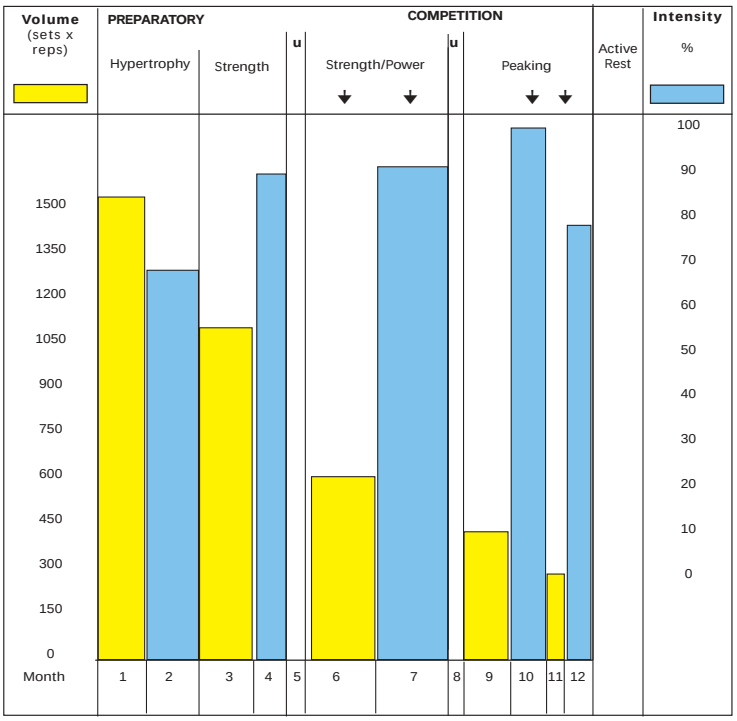
The next mesocycle is the strength phase. During this training phase training intensity is increased, while the training volume is reduced. The primary emphasis during this mesocycle is focused on increasing maximal strength. In addition, the cardiovascular conditioning program will continue. To allow the athlete to adequately recover from this training cycle another unloading phase may be added.

The next mesocycle will be the strength/power phase. During this training cycle the Olympic exercises (i.e. power cleans, push press, high pulls), if not already part of the training program, may be included. The exercises used will have a greater specificity to the movements on the field of play, and provide a greater opportunity for strength carryover. The intensity of exercise will be elevated further, while the training volume (related to the reduced number of repetitions, as the number of sets per exercise might remain constant) is decreased. During this training phase incorporation of plyometric exercises may also be included into the training program. In addition, sport specific conditioning, agility and speed training can also be integrated into the 2 - 3 day per week conditioning program.

The next phase of training that precedes training camp is of shorter duration (four to six weeks) and is designed to bring the athlete to both peak strength and condition for the start of the football season. During this peaking phase training intensity is further elevated, while the volume of resistance training is again reduced. This is accomplished by reducing the number of assistance exercises in the resistance training program. By this phase of training the athlete should be primarily concentrating on getting into the proper physiological condition to play football. Emphasis in the conditioning program will be on anaerobic training (i.e. intervals, both long and short sprints, and agility exercises). The plyometric exercises incorporated into the previous mesocycle should still be included in the training program.

As the athlete reports to training camp this initiates the beginning of the pre-season period, which will last until the start of the regular season. During this period and for the remainder of the competitive season, the resistance training program may be reduced to a two-day per week maintenance program. The maintenance phase generally incorporates the core exercises with several assistance exercises.

**Figure 2: An annual periodized training program for a strength/power athlete preparing to peak for a single event**




u = unloading week

☆✱ = Preseason

## Periodized Training Program for a Strength/Power Athlete Preparing for a Specific Event

An example of an annual periodized training program for a strength/power athlete preparing to peak for a single event can be seen in **Figure 2**. In the previous example we saw how in an athlete participating in a sport that has a well-defined off-season, pre-season and season, dividing the year into precise mesocycles is easily accomplished. However, in preparing an athlete to peak for a specific event, which often occurs at the end of the competitive season, precise control of the training variables is required in order to have the athlete peak at the desired time. Unlike the team sport in which there is some room for maneuverability, a mistake in the training prescription for an athlete preparing for a single competition would result in an undesirable outcome. Either the athlete would not reach peak condition by the time of the contest, or the athlete may peak too early and possibly overtrain in an attempt to maintain that high performance level for an extended period of time.

During the initial phase of training the program is quite similar to what is typically seen for the strength/power athlete participating in a team sport. However, the competitive phase may be quite long with many of the earlier competitions considered being of lesser importance. In this instance the athlete will 'train' through those early competitions, preferring instead to peak for the more important competition at the end of the year. During this competition period the major difference between this athlete and the athlete participating in the team sport will be the absence of a maintenance phase. The athlete preparing for a single competition may have several mesocycles occurring during the early to mid-competitive year and then enter a peaking phase to maximize performance prior to the competition.

In many sports there is both an indoor and an outdoor season (i.e. track and field). In this situation there are two competitive seasons, each having a competition that the athlete will primarily focus on. These two competitive seasons would be linked through a short unloading period. The approach to each training cycle would be similar to what was previously described above for an athlete preparing for a single competition. However, if greater importance was placed on the competition during the second cycle then training volume would be higher in the preparatory phase during the first training cycle, and be of shorter duration. Changes in training intensity will be similar during each training cycle.

The challenge of multi-cycle training programs is the reduction in the preparatory phase of training. The higher training intensities performed more frequently during the year places the athlete at a greater risk for overtraining. It is likely that such training programs are best suited for more advanced athletes due to their experience and ability to adapt to this high physical demands.

## Summary

The goal of periodization is to maximize the potential of the athlete to reach peak condition by manipulating both training volume and training intensity. Through proper manipulation of these training variables, not only will the athlete peak at the appropriate time, but also the potential risk for overtraining is reduced. The use of periodized training programs has proven to be more advantageous than nonperiodized training, but these benefits may be more relevant for the experienced athlete.

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## About the Author


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# FitnessFrontlines

Ed Burke, PHD, CSCS

## Protein/Carbohydrate Drink Increases Muscle Growth . . .

Consuming a protein drink immediately after weight-training exercise dramatically stimulates muscle growth and repair, according to a new report from researchers at Vanderbilt University Medical Center. In the study, a group of athletes were given either a placebo drink (no protein, carbohydrate or fat), a carbohydrate drink (8 grams of carbohydrate) or a drink containing 10 grams of protein, 8 grams of carbohydrate and 3 grams of fat immediately following intensive leg training exercise. Compared to the placebo, the carbohydrate drink did not alter whole-body protein synthesis during the recovery period; in contrast, the protein plus carbohydrate drink increased leg protein synthesis six-fold and whole-body protein synthesis by 15 percent. "These findings suggest that the availability of amino acids (protein) is more important than the availability of energy (carbohydrates) for post-exercise repair and synthesis of muscle proteins," conclude Dr. D.K. Levenhagen and colleagues.

Levenhagen D. 2002. Postexercise protein intake enhances whole-body and leg protein accretion in humans. *Medicine & Science in Sports & Exercise*. 34:828 – 837.

## Which Sex is Better at Burning Fat?

Research continues to surface that women metabolize more body fat during aerobic exercise than men do. So why doesn't the fat seem to melt off of women as easily as it seems to for many men? The latest study reported in the American Journal of Physiology: Endocrinology may shed some light. Scientists compared 21 men and 21 women, matched relative to their training level, during 90 minutes of moderate-intensity exercise. All subjects ate the same controlled diet for eight days before training. The women, on average, realized a 25% decrease in muscle triglyceride (fat) levels, regardless of their training experience (untrained, moderately trained or endurance trained). On the flip side, the men's intramuscular triglyceride levels were statistically unaffected by exercise. What does this mean? It looks as though the additional fat that women metabolize comes from fat located in muscle and not the more noticeable areas under the skin.

Steffensen H, et. al. 2002. Myocellular triacylglycerol breakdown in females but not in males during exercise. *American Journal of Physiology: Endocrinology and Metabolism*. 282: E634 – E642.

## Moderate Physical Activity Reduces Risk of Colds . . .

It is well known that extreme physical exertion increases the risk of developing an upper respiratory tract infection, but previously, little data existed that described differences in the risk of infection between low and moderate levels of physical activity. Researchers from the University of South Carolina and the University of Massachusetts examined rates of upper respiratory tract infections (URTI) among inactive and moderately active middle-aged adults. The study followed 641 healthy men and women for one year. After collecting and analyzing the data, the researchers found that roughly 40 percent of the group reported colds in the fall and winter and ten percent reported colds during summer. They found that moderate levels of activity reduced the annual risk for URTI by 23 percent relative to lower levels of activity, after controlling for a number of other factors. In the fall of the year, moderate levels of activity reduced risk by about 30 percent. The incidence of UTRI is quite high among adults (1-5 illnesses per year), and these infections are the major contributor to individuals being incapacitated in Western countries. For example, it is estimated that 100 million colds per year in the United States were responsible for 250 million days of restricted activity and 30 million days of lost work. Clearly, the effect of URTIs on health care cost and worker productivity is substantial. The present findings support the hypothesis that moderate levels of physical activity can reduce the risk of URTI by 20-30%.

Matthews C E, et. al. 2002. Moderate to vigorous physical activity and the risk of upper-respiratory tract infection. *Medicine and Science in Sport and Exercise.* 34:1442 – 1448.

## Iron Can Aid Women's Aerobic Training . . .

Iron supplementation has been shown to help pre-menopausal women exercise longer and harder, according to a recent study. Based on the premise that iron deficiency without anemia occurs in about 12 percent of premenopausal women in the United States, and may reduce their endurance capacity in aerobic exercise. The subjects in this study were 41 healthy women aged 18-33, all of whom had iron deficiency, but were not anemic. They were given either a 50 mg iron supplement or a placebo twice daily for six weeks in a randomized, double-blind trial. During the last four weeks of the study, they trained five days a week on an ergometric cycle equipped with a heart rate monitor and digital output of cadence and work. They gradually increased their workouts until they were cycling for 10 minutes at 75 percent and 15 minutes at 85 percent of their maximum heart rates. According to the researchers, the iron-supplemented group experienced double the improvements in maximal oxygen uptake and respiratory exchange ratio than the placebo group. The women with the greatest initial iron deficiency experienced the most improvement in their adaptation to aerobic exercise.

Brownlie T, et. al. 2002. Marginal iron deficiency without anemia impairs aerobic adaptation among previously untrained women. *American Journal of Clinical Nutrition*. 75:734 – 742.

### About the Author

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# Strength Training For Power

Roger Marandino, MS, CSCS

Power is the rate at which work is performed. Power is also defined as force multiplied by velocity. For example, moving a heavy weight very fast requires more power than moving that same weight slowly. In athletics, both power and strength are visible qualities in all motions. Some sport coaches view strength as the ability to resist injury or fight for proper position on the field such as boxing out and rebounding in basketball. Power, on the other hand, may be viewed as speed of movement or quickness in running or jumping.

## Fast vs Slow Lifting?

When selecting drills and exercises for power training you need to observe the speed of the exercise. For example, a well-known strength exercise like the deadlift may take 2 – 4 seconds to complete with an average to heavy load. In comparison, the full clean portion of the clean and jerk (power exercise) can be completed in as little as 0.09 second, with similar load requirements. Deadlifts or squats are not slow lifts, but they are slower than power cleans or snatches. Because velocity is an important component of power, it makes sense to utilize exercises such as power cleans or snatches which are fast by design.

To get the most "bang for your buck", training programs should take into account the individuality of the subjects being trained. In relation to power, it is my empirical observation that if the subjects being trained lack general strength, they should work to develop this first in order to gain the most benefit from subsequent power training.

If we look at the strength variables of two athletes, it will be easy to understand. For the sake of this illustration, both athletes are 6'2" tall and weigh 250lbs. Athlete #1 is a novice shot putter with little strength training experience. Athlete #1's weightlifting variables are as follows: bench press 185lbs., squat 250lbs., and power clean 185lbs. Due to this athlete's lack of training experience, his strength is poor for someone his size. This athlete first needs to develop general strength in order to make gains in power. General strength will allow him to hold correct posture during throwing and to aid in injury prevention. Athlete #1 would greatly benefit from more traditional strength exercises such as squatting and pressing movements. Also, these exercises should be performed during a hypertrophy phase where the volume (sets multiplied by repetitions) of training is high (4 – 6 sets, 20 – 8 reps) and the intensity [percent of a 1 repetition max (1RM)] is low (45% – 70%). This type of training is designed to increase lean muscle mass.

Athlete #2 has many years of sport and strength training experience. His training methods and goals should therefore be planed accordingly. This athlete should focus on exercises, which are fast by design and stimulate the central nervous system to excite and

recruit the working muscles quickly. Drills such as plyometric throwing with weighted medicine balls or Olympic style lifts should be the mainstay of the training regimen.

The thinking behind this type of training is that it is believed one of the main reasons we become more powerful is due to our central nervous system's ability to coordinate our working muscles to perform a specific skill. Also, without getting into to too much detail, our muscles are comprised of both fast twitch motor units, and slow twitch units. For power, we want to recruit and train the fast twitch fibers.

## Types of Exercises

Below is a list of five basic power drills, as well as a brief description. All are common, yet each exercise has many variations. It is my advice that you learn the basic drills first, and then move on to variations.

1. Power Clean

2. Power Snatch

3. Jump Squat

4. Box Jumping

5. Dumbbell Clean and Jerk

### Power Clean:

This exercise is a modification of the full clean motion of the competitive clean and jerk lift. The idea of the lift is to move the barbell from the floor to the shoulder in one explosive motion.

### Power Snatch:

This drill is similar to the power clean in many ways. Exceptions are that the grip is wider and the barbell is caught over the head. Again, the lift is executed in one quick motion.

### Jump Squat:

This drill is a variation of the traditional Olympic style squat. The athlete stands with the barbell on his shoulders and proceeds to perform a regular squat. When the athlete moves from the downward to upward position, he is taught to push hard against the ground in order to "jump." The athlete then absorbs the jump in the next squat and repeats the next repetition. Special emphasis is placed on maintaining a firm grip on the bar and correct posture. Loads lifted are generally low, 15 - 35% of a squat 1RM.

### Box Jumping:

There are too many variations of this drill to list. You can think of a box jump like a power clean or snatch. It requires a lot of power to move a heavy weight from the floor to your shoulders or even overhead. It also requires a lot of power to move your bodyweight 3.5 - 5 feet from the floor to jump on a box. Start with the box height relatively low and increase the height once the athlete becomes comfortable with the exercise and has mastered the lower height jump.

### Dumbbell Clean and Jerk:

This drill is a variation of the Olympic clean and jerk, except with one dumbbell in each hand. The lift is started from the floor with each weight turned so they are parallel with the athlete's feet. As the athlete moves from the floor, special emphasis is placed on keeping the back flat and protected. When the dumbbells reach knee height or slightly above, the athlete "jumps" the dumbbells to the catch position on the shoulders. The athlete then quickly bends their knees and reverses that effort in order to jerk (quickly extend) the dumbbells overhead.

## Order of Exercise

During daily workout sessions, most power type exercises should be performed first. There are many logical reasons for this. Empirical observation shows that your nervous system is fresh and able to move your working muscles quickly in the beginning of a workout as compared to the end. Also, if an athlete has to perform an exercise like a back squat before a power clean, then the muscle of the back will most likely be too fatigued to hold correct posture during the more explosive power clean. This now becomes a potential safety problem. Therefore, if fatigue is present during power training, the athlete will struggle to complete the exercises safely let alone move with the desired power.

## When to Train for Power

Strength and conditioning coaches often debate this subject. One thought is to train for power only during competition phases of training. Another is to train year round for power. It is my opinion that power training should be performed year round giving it a special emphasis during the in season competition phases. My reasoning is this. It takes many years to master complex power exercises like the snatch and power clean. Therefore, practice is needed. If athletes remove these exercises completely from training for weeks or months they effectively stop practicing them. Also, most high school aged athletes play multiple sports. Often their competition phase in one sport may run into a general conditioning phase in another. In this case, it would make sense to put a special emphasis on power training during the competition phase.

The following is a sample of a three-week competition phase. Remember, a general strength base should be established prior to serious power training.

# Sample Competition Phase

| DAY 1 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Power Clean | 5x2 | 90% |
| Squat | 3x2/3x2 | 80%/90% |
| Lunge Walk | 6x12 | |
| Dumbbell & Jerk | 5x3 | |
| Box Jump | 6x3 | |
| Abdominals | 4x20 | |

| DAY 2 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Push Press | 5x2 | 90% |
| Bench Press | 5x2 | 90% |
| Pull Down | 5x5, 3x3 | |
| High Pull | 5x4, 2x2 | 70%/75% |

| DAY 4 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Power Clean | 5x1 | 88% |
| Power Clean to Front | 3x3 | 80% |
| Squat | | |
| Leg Press | 5x3 | 125%/squat |
| Leg Curl | 5x5 | |
| 25m sprint start | 6x25m | |
| | | |

| DAY 5 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Narrow Grip Bench Press | 6x3 | 90% |
| Pull Ups | 40 reps | |
| Jump Squat | 5x3 | 50% of Squat |
| Dumbbell & Jerk | 4x3 | |
| Abdominals | 4x20 | |

| DAY 8 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Power Clean | 3x2/3x1 | 88%/95% |
| Squat | 3x1/3x1 | 90%/95% |
| Snatch Lunge Walk | 6x12 | |
| Double Step Up | 6x12 | |
| Box Jump | 5x3 | |
| Abdominals | 4x20 | |

| DAY 9 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Push Press | 2x2/3x1/3x1 | 90%/95%/85% |
| Low Row | 5x5 | |
| Bench Press | 4 x 1 | 95% |
| Dumbbell shoulder Press | 5x5 | |
| Abdominals | 5x10 | |

| DAY 11 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Power Clean | 4x1/4x1 | 88%/80% |
| Romanian Deadlift | 3x6 | 70% |
| Dumbbell Clean & Jerk | 5x2 | |
| High Pull | 5x2 | 80% |

| DAY 12 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Narrow Grip Bench Press | 6x2 | 85% |
| Jump Squat | 5x5, 3x3 | 40/50% of Squat |
| Pull Down | 6x5 | |
| Pull Ups | 50 reps | |
| Dumbbell Clean & Jerk | 4x3 | |
| Abdominals | 4x20 | |

| DAY 15 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Power Clean | 3x2/3x1 | 88%/95% |
| Squat | 3x1/3x1 | 90%/95% |
| Snatch Lunge Walk | 6x12 | |
| Step Up | 6x12 | |
| Box Jump | 5x3 | |
| Abdominals | 4x20 | |

| DAY 16 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Push Press | 2x2/3x1/3x1 | 90%/98%/85% |
| Low Row | 3x8, 5x5 | |
| Press Behind Neck | 4x5 | |
| Abdominals | 5x10 | |

| DAY 18 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Power Clean | 4x1/4x1 | 88%/80% |
| Romanian Deadlift | 3x6 | 70% |
| Dumbbell Clean & Jerk | 5x5 | |
| High Pull | 5x1 | 85% |

| DAY 19 | | |
|---|---|---|
| **DRILL** | **SETS X REPS** | **PERCENT** |
| Narrow Grip Bench Press | 6x2 | 85% |
| Jump Squat | 5x2 | 60% of Squat |
| Pull Down | 6x5 | |
| Pull Ups | 50 reps | |
| Box Jump | 4x3 | |
| Abdominals | 4x20 | |

## Summary

1. When training for power, select exercises that are fast by design, such as Olympic lifts or plyometric jumps.
2. If general strength levels are poor, time should also be spent to develop this by performing strength exercises such as squats and presses.
3. Training for power should be performed year round giving it a special emphasis during competition periods.

## About the Author

*Roger Marandino, MS, CSCS*D earned a master's degree in sport biomechanics from the University of Connecticut. He competed on the national level in the sport of drug-free power lifting, winning three national titles, and is a USWF Olympic Weightlifting Coach. Marandino was the strength coach of the year for the Ivy League in 1997.*

# A Sample Program for Periodizing the General Athlete

David Sandler, MS, CSCS

Periodization is the systematic varying of repetitions, sets, and intensity to peak the athletes conditioning at a specific time of the year. While athletes completing in a structured sport will have a predetermined season to periodize their program around, the recreational athlete does not have this option. The following article shows how to develop a periodized program for the recreational athlete, using the calendar year as the season.

To develop skills, the skills must be practiced. However, in an attempt to become as efficient as possible, the body will adapt to the specific stimulus, maintaining its homeostasis. This homeostasis is most often associated with staleness, or more commonly, plateauing. Further, this state often leads to injury or overtraining. To prevent this, a periodized program needs to be adapted, modified, and specifically set to meet the demands of your particular sport.

## Phases of the Periodized Program

While traditional periodization follows a pattern of hypertrophy, strength, power and peaking, it is not necessary for all sports to follow this format. In fact, in many sports it is unnecessary to attempt a 1RM.

The hypertrophy phase is a name given to a period within the pre-season and usually a period in where the athlete returns to his/her normal level after the off-season. The hypertrophy phase is designed to increase the athlete's muscle mass, preparing them for higher intensity work to follow. Hypertrophy training involves sets in the 8 – 12 repetition range.

The second phase of the program, the strength phase, is the period that usually best prepares the athlete for competition. It features a moderate number of repetitions (5–8), and slightly longer rest periods (3 – 5 minutes) between each set. This phase also occurs in the pre-season and is marked by its strength increasing design.

The power phase is a short phase that occurs immediately before or during the season. It typically features a small number of repetitions (3 – 5), which are used in more explosive exercises and movements. Rest between sets is relatively long, sometimes reaching as much as 7 – 10 minutes.

The peaking phase is the period where the athlete peaks for a particular event or in the case of a team sport, the playoffs. In terms of resistance training it represents the "maxing" or testing of the athlete, and generally features 1 – 3 repetitions.

The recovery phase may either be a long rest period (days off) or an active rest period, and normally occurs at the end of the competitive season. Many people are concerned about detraining during this phase. The likelihood of losses during this time are minimal provided some activity is performed, thus the recovery period allows for recovery and rebuilding.

Table 1*: Phases of the Periodized Program

| | Hypertrophy | Strength | Power | Peaking |
|---|---|---|---|---|
| **Sets** | 2 – 4 | 2 – 5 | 3 – 5 | 1 – 3 |
| **Reps** | 8 – 20 | 4 – 8 | 3 – 5 | 1 – 3 |
| **Volume** | High | High | Low | Low |
| **Intensity** | Low | Med High | High | Very High |

***This table is adapted from Fleck and Kraemer, Designing Resistance Training Programs.**

## Steps in Planning the Program

The first step is determining each of the seasons, and setting the macrocycle or complete program. The next step is to break down the complete program into smaller mesocycles and microcycles. Finally, determine the phase, or combination of phases, you will use within each mesocycle. Then figure out the actual exercises for weight training and intervals for the anaerobic/aerobic metabolic conditioning.

Each periodized program should have a goal. It should be specific to the sport and/or the athlete. For periodization to work, it must be followed strictly.

## Programming the Complete Athlete

The essence of any good program is the planning and preparation that goes into it. A thorough needs analysis of the sport requirements and the athlete's conditioning level is necessary to design the ideal program. There are however, certain rules and exercises that can be generally applied across many sports. The following periodization program is geared to the recreational athlete, or dedicated fitness enthusiast. The program is progressive and attacks the important elements of fitness and athleticism.

## Developing the Program

To develop a sound training program, it is necessary to examine the sport requirements and/or client goals. We will use a needs analysis approach and develop a program using a hypothetical athlete. We will assume the client is able to perform the exercises selected and has been cleared to exercise. It will also be assumed that the athlete is looking to improve overall strength and energy.

Depending on time, it may be necessary to vary workouts from 2 to 4 times per week. Since we will try to develop strength, power, balance, speed, and agility, we will favor doing a two-day or three-day workout. If time permits, the two-day workout can be doubled, making four work days during a week. To develop overall skills, we will stick to gross movements consisting of multiple joint exercises in the weight room, and take it to the field for the conditioning and other components.

The first thing to do is to determine the relative energy requirements of the particular sport the athlete is interested in. In the case of many recreational athletes, this will vary quite a bit, as most are involved in several activities. The second component of our training prescription is deciding on the appropriate number of repetitions and sets for both resistance training exercises, and balance, agility, and power related exercises. Again, we need to be specific in terms of applying suitable volume based on sport need. For the general fitness enthusiast, repetition range should be between 5 and 12.

Keeping in mind that time is always an issue, we recommend doing a complete body workout preceded, or followed by interval training, plyometrics, agilities and rotational training. This will depend on the time of year and the client's needs.

## Interval Training

Interval training is a very good method of training because it allows maximal effort for repeated trials. This benefit allows more time at the maximal level because the rest interval will allow recovery. Rather than performing one continuous session or short session, multiple sessions can be performed on the same training day. Thus, two, three, four, or more times the amount of work can be performed. However, it should be noted that for best results, the athlete must give 100% effort both mentally and physically for the prescribed times in each interval.

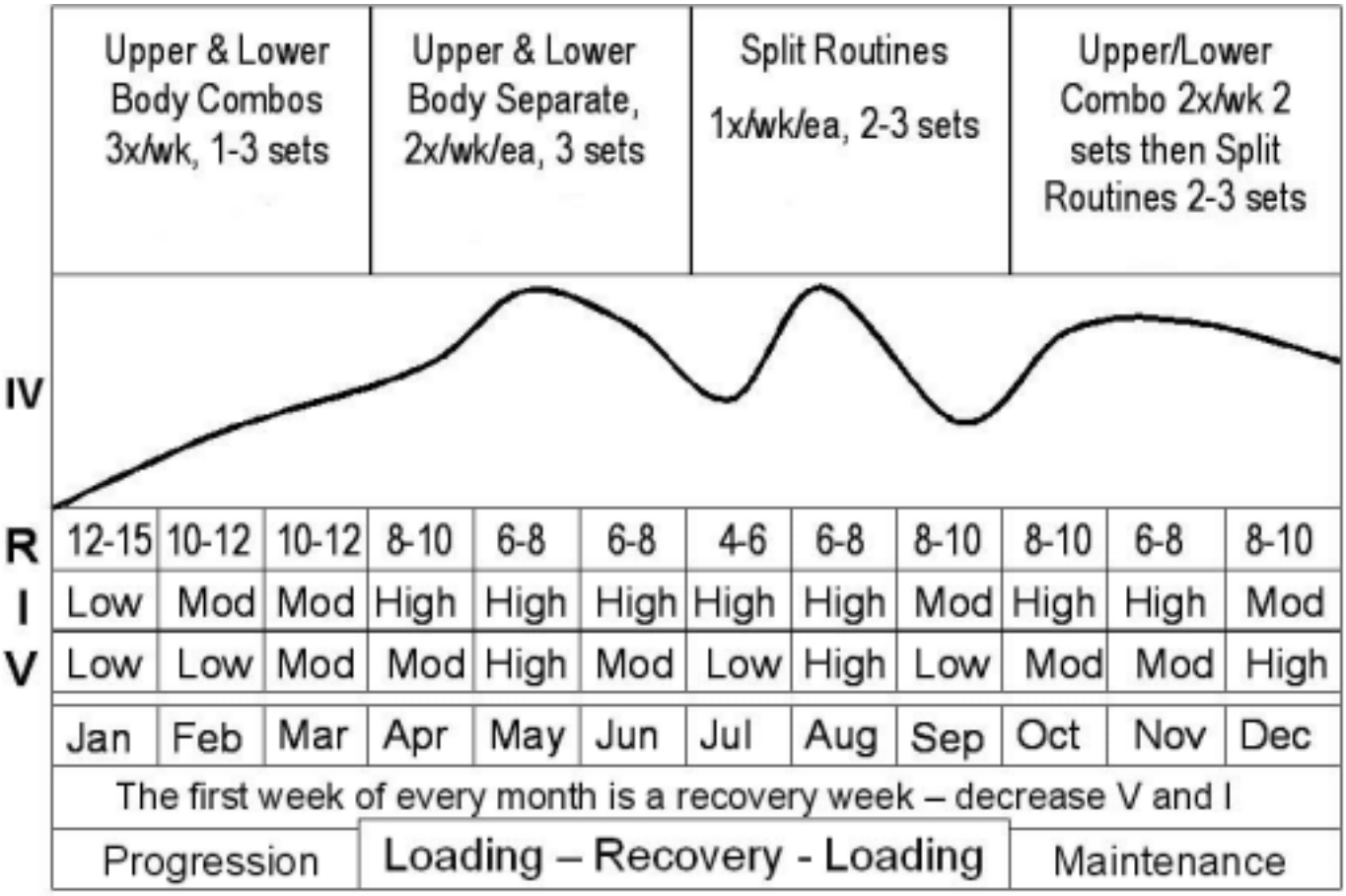


Table 2: Combo Routines

| Day 1 | Day 2 | Day 3 |
|---|---|---|
| Squat or Leg Press | Lunge | Bench Press |
| Bench Press | Dumbbell Press | 3 Position Pulls* |
| Pull-up | Dumbbell Row | Squat |
| Step-up | Leg Extension | Leg Curl |
| Incline Dumbbell Press | Dumbbell Press | Calf Raise |
| Bent Over/Machine Row | Leg Curl | Superset Bicep Curl and Tricep Extension |
| Romanian Deadlift | Biceps | |
| Rotator-Cuff Circuit | Triceps | |

## Table 3: Upper-Lower Routines

| Upper 1 | Upper 2 | Lower 1 |
|---|---|---|
| Bench Press | Pull-Up | Step-Up |
| Incline Press | Dumbbell Bench Press | Lunge |
| Military Press (standing) | Dumbbell Row | Squat |
| Triceps Extension | Incline Dumbbell Press | Leg Curl |
| Bent-Over Row | Dumbbell Shrug | Romanian Deadlift |
| Lat Pull-down | Dumbbell Triceps Extension | Plantar Flexion |
| Shrugs | Dumbbell Curls | Dorsi-flexion |
| Biceps Curls | | |

## Table 4: Split Routines

| Push | Pull | Push/Pull Combo |
|---|---|---|
| Bench Press | Cable/Pulley Row | Lunge |
| Squat | Deadlift | Incline Dumbbell Press |
| Military Press | Chin-Up | Step Up |
| Step Up | Leg Curl | Upright Row |
| Triceps Extension | High Pull | Russian Deadlift |
| Calf Raise | Biceps Curl | Biceps |
| Back Extension | Crunch | Triceps |
| | | Crunch w/ Twist |

## Varying Routines

Periodization is the act of changing routines to meet needs. Identifying those needs allow us to build a good program. It is our suggestion that no cycle should last more then 4 to 5 weeks and that the end of each cycle include a "tapering" or "detraining" week to prevent staleness. Overall, the volume and intensity should reflect the time of year and clients specific goals, with lower volume and intensity work occurring during busy or active times and high-volume work when more time and effort can be afforded towards the workouts.

## Summary

Periodization is a necessity, especially when looking at the true metabolic and biomechanical demands of the sport. A key component for developing good programs is the ability and the knowledge to for-see problems and have a method to modify them. When using periodization, the percentage-based method should only be used with sports requiring "one-time" peaking such as lifting or certain track and field events. However, it does not mean that it is wrong to use the %1RM method for your sport. In most cases however, it is suitable to use the "best set" as the basis for the program.

## References

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### About the Author

*David Sandler, MS, CSCS David is a professor of Exercise Physiology and Strength & Conditioning at Florida International University, one of the first schools to receive recognition from the NSCA. He developed and directs the Strength and Conditioning Curriculum. David, a former strength and conditioning coach with the University of Miami, is completing his doctoral work in their Exercise and Sports Science Department. He is a frequent contributor to several fitness magazines and has presented at numerous national conferences and conventions throughout North America. David is a founding partner in StrengthPro, a Miami based strength consulting firm.*

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