

# Basic Principles of Strength Training and Conditioning

John M. Cissik, MS, CSCS

# W

Whether you are a recreational weight trainer, a weekend athlete, or a strength coach working with elite athletes, it is important to be principled when designing strength and conditioning programs. By adhering to certain fundamental principles you will ensure that your workout programs produce the desired gains.

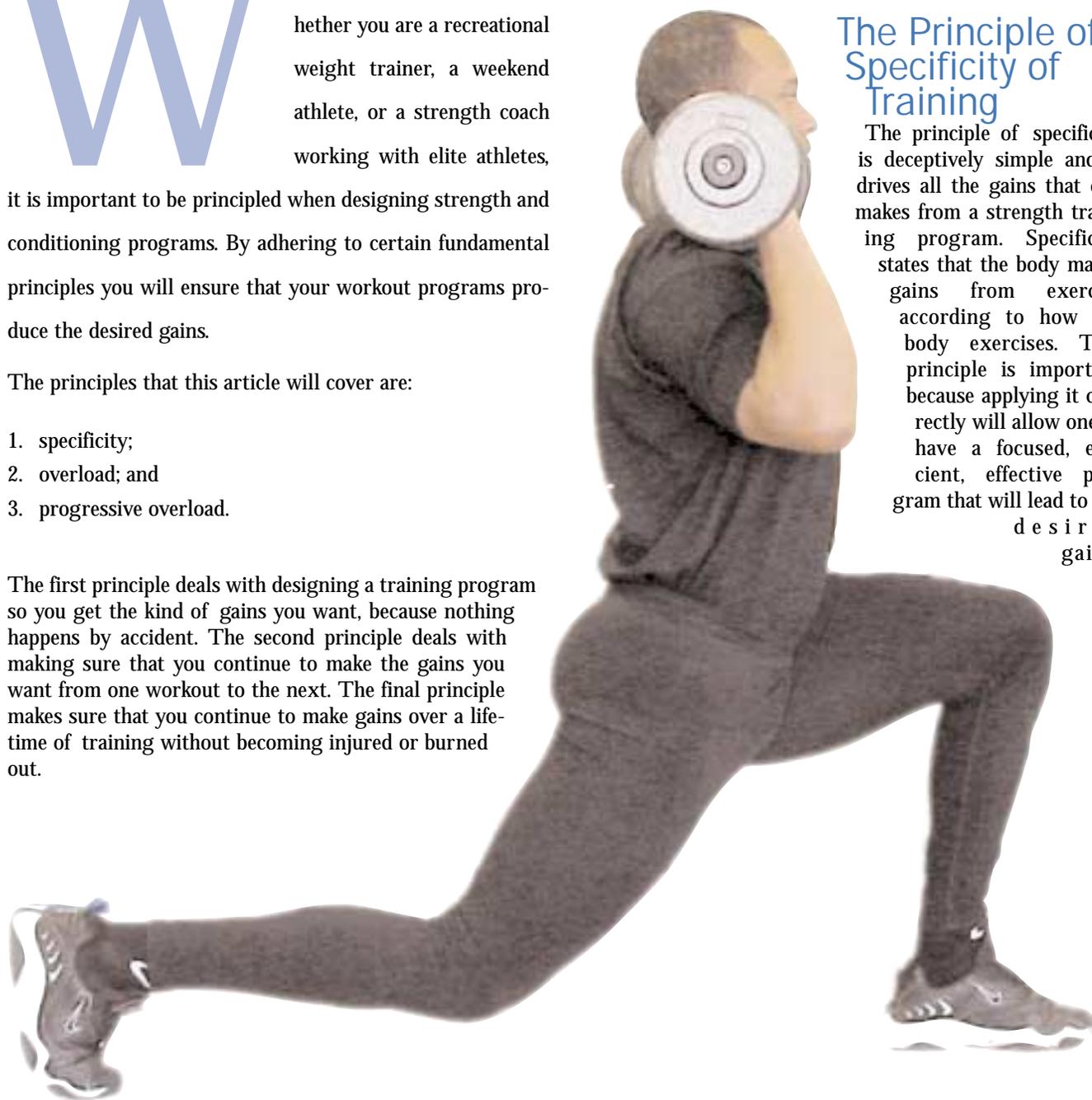
The principles that this article will cover are:

1. specificity;
2. overload; and
3. progressive overload.

The first principle deals with designing a training program so you get the kind of gains you want, because nothing happens by accident. The second principle deals with making sure that you continue to make the gains you want from one workout to the next. The final principle makes sure that you continue to make gains over a lifetime of training without becoming injured or burned out.

## The Principle of Specificity of Training

The principle of specificity is deceptively simple and it drives all the gains that one makes from a strength training program. Specificity states that the body makes gains from exercise according to how the body exercises. This principle is important because applying it correctly will allow one to have a focused, efficient, effective program that will lead to the desired gains.



Failing to apply it will result in wasted energy and time, and it will result in frustration as gains do not materialize.

When developing a conditioning program, you should consider the following:

- the movements to be trained;
- the muscles and joints to be trained;
- the energy system(s) to be trained; and
- the speed of movement.

Strength and conditioning programs can be designed to enhance movements that are performed in athletics. This is important because this may improve an athlete's performance. It may do this by strengthening the movement; it may also accomplish this by allowing the athlete to practice the movement with resistance. It is also important because it can maximize an athlete's training time and be used to help prevent injuries in the athletic event. A number of questions should be considered to help with this:

1. Is the activity performed standing?
2. What joints perform the activity?
3. Do the joints work together or sequentially? If sequentially, what is the sequence of movement?
4. What motions are performed by each joint?

For example, basketball players want to become better vertical jumpers. The vertical jump is performed standing up. Both feet are in line and approximately hip-width apart. The descent is performed by pushing the hips down and back, followed by knee flexion until a quarter squat has been achieved. There is little or no pause at the bottom of the squat. The athlete then explosively extends the knees, hips, and plantar flexes the ankles until he or she has left the ground. There are a number of exercises that share similarities with the movement that has been described, these

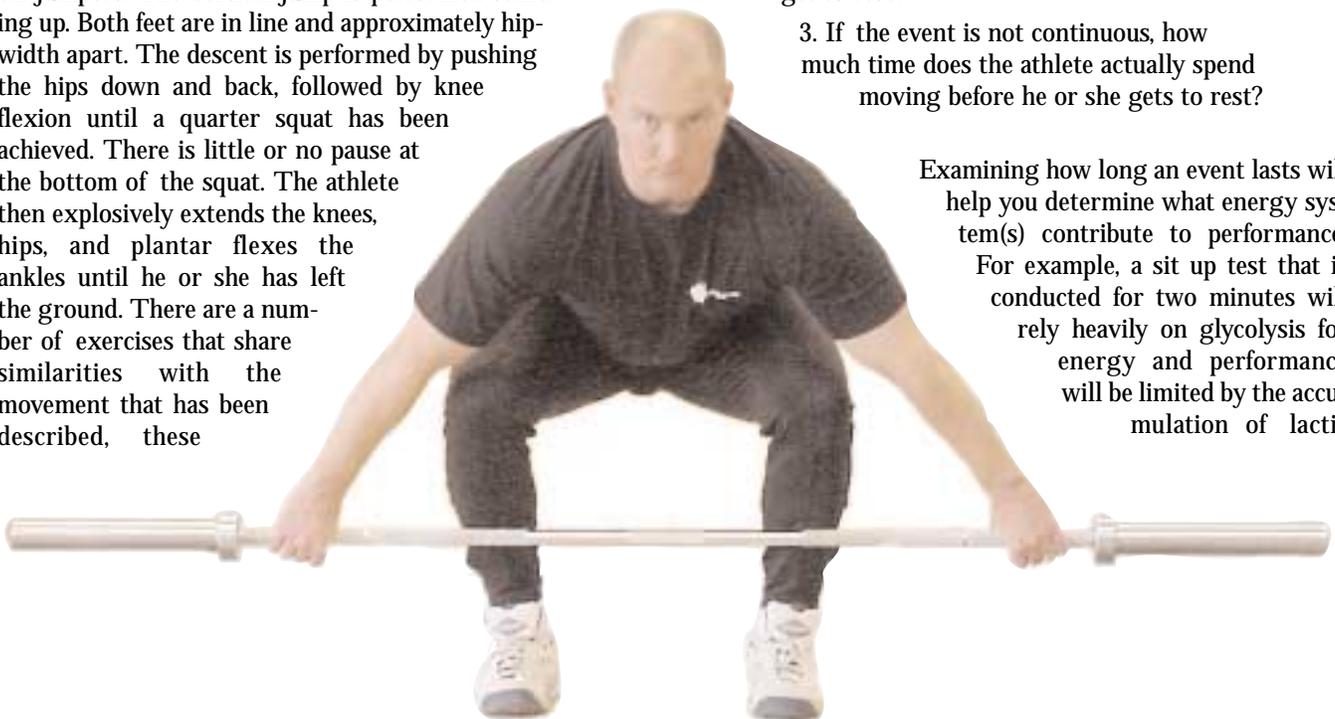
include: the back squat, the front squat, the power clean, the power snatch, and the jerk to name a few. While exercises like the leg extension and the leg curl may strengthen the knee flexors and extensors, they do not involve exerting force against the ground and do not prepare the athlete to use his or her hips, knees, and ankles together.

While movements are important, there are times when you may want to address specific muscles or joints in a conditioning program. This may be to prevent injuries, to rehabilitate injuries, or to achieve a certain appearance. For example, a baseball pitcher may want to train the rotator cuff muscles, or a sprinter may want to address the hamstring muscles. You may want to target certain muscles to make them hypertrophy for appearance, for example a body builder's biceps. While movements are important for designing a conditioning program, addressing specific muscles or joints may be necessary at times.

Addressing movements, muscles, or joints assists with selecting exercises. Things like workload, rest, and intensity are driven by the energy system(s) that you want to train. Energy system training is critical to improving athletic performance. Often performance is limited by your energy stores and your ability to replenish them, both of which are trainable. You can design conditioning programs to enhance the energy system(s) that are used in an athletic event. To do this, consider the following:

1. How long does the event last?
2. Is the event performed continuously? Or does the athlete get to rest?
3. If the event is not continuous, how much time does the athlete actually spend moving before he or she gets to rest?

Examining how long an event lasts will help you determine what energy system(s) contribute to performance. For example, a sit up test that is conducted for two minutes will rely heavily on glycolysis for energy and performance will be limited by the accumulation of lactic



acid. A hundred meter sprint that lasts ten seconds will rely heavily on the available stores of ATP and will be limited by the amount on hand.

The length of the event can be deceptive, however. For example, a football game might last two hours. Just looking at the length of time might seem to indicate that the aerobic energy system needs to be trained for football players. In this case one needs to consider if the athletes are moving continuously. In the case of football the answer is no, the athletes rest between plays and have a chance to recover their energy stores. In this case one should consider how much time the athlete actually spends moving before they get to rest. The average play may only last five or six seconds, which would indicate that the sport is primarily dependant upon the levels of ATP in the muscles.

Energy system training is an important consideration because it helps to dictate how much weight to use, how many repetitions to perform, and the amount of recovery time. If you are interested in increasing the stores of ATP, then training will involve heavy weight, low repetitions, and lots of rest. Glycolytic training will involve moderate reps, moderate weight, and little rest. Aerobic training means lighter weights, many repetitions, and no rest.

A final consideration with specificity concerns the velocity of movement. The gains from exercise are specific to the velocities that the exercises are

performed at. If exercises are performed at slow speeds, then we become stronger at slow speeds; however, there is little transfer to faster speeds. If exercises are performed at faster speeds, then we become stronger at faster speeds. This is important for athletics because few sports are performed at slow speeds.

If one is designing a conditioning program for a sport that is performed at high speeds, then one will need to include exercises that make athletes stronger at high speeds. These include things like the variations of the Olympic-style lifts (the clean, the snatch, and the jerk), plyometric exercises, and sprints.

The principle of specificity is important because it dictates what gains are made. The next principle is important because it ensures that you continue to make gains from your training.

## The Principle of Overload

The overload principle states that in order to keep making gains from an exercise program, you must find some way to make it more difficult. This is because bodies adapt to exercise. The problem is that once your body adapts to a given workload, it will not continue to adapt unless the workload is increased somehow. If you do not continue to adapt, then eventually you will plateau and regress.

Having stated that it is necessary to make conditioning programs more difficult, one caution should be kept in mind: you must observe specificity when applying the overload principle. Performing a set of twenty might be a way of making the workout more difficult, but if you need to enhance the phosphagen energy system then you are violating specificity.



There are a number of ways to apply the overload principle to a strength and conditioning program:

1. increase the weight lifted;
2. increase the volume of work;
3. change the exercises employed;
4. modify the order of the exercises; and
5. alter the rest periods.

Increasing the weight that is lifted will make the workout more difficult. Heavier weights will force your muscles, connective tissue, bone and nervous system to adapt. Lifting heavier weights will also cause you to initially perform fewer repetitions with the weight.

Increasing the volume of work—either number of sets, number of repetitions, or some combination thereof—will result in your body having to adapt to it. This is one of the main ways to elicit larger muscles and connective tissue adaptation from strength training. One should be careful with this method of applying overload; a volume that is too great will train the wrong energy system.

Changing the exercises employed is a way to increase overload that many individuals are reluctant to use. Many people feel that the exercises they are performing are the only ones that can elicit certain gains. This is not so. Changing the exercises has a number of benefits, including keeping the workouts interesting and requiring your body and nervous system to adapt to resistance imposed in a totally different way.

There are many exercises that train the same movement and the same muscle groups,



this means that you do not have to rely on one exercise to train a given area. For example, the back squat trains the muscles of the hip, knee, and ankle in a manner that involves exerting force against the ground, it loads the bones of the vertebral column and lower body, and is performed standing up. There are a number of exercises that do the same thing and that may be substituted for the back squat:

- Pause squats;
- Eccentric squats;
- Front squat; and
- One-legged squats.

Any of the above exercises may be used to increase lower-body strength in a way that also loads the bones of the spine and lower body and is performed standing up.

The order that exercises are performed is another way to provide overload. By changing when exercises are performed, you make some exercises more difficult to perform and others easier. For example, in your current workout your exercise order may look like this: bench press, incline press, dumbbell flies. Now, let's change the order of exercises so that the new workout looks like this: dumbbell flies, incline press, bench press. The result of this change is that you will be able to lift more weight on the dumbbell flies and incline press, because they are performed while you are fresher. You will lift less weight on the

bench press, because it will be performed while you are fatigued. Not only will you become stronger on the first two exercises, but you will also keep your workouts interesting and this will also help your body to adapt in a different manner because you are focusing on the first two exercises instead of the bench press.

A final way to provide overload is to modify the amount of rest. This must be used carefully to ensure that you are observing specificity. By increasing the amount of rest in between sets, you allow your body to recover more completely. This means you will be able to lift heavier weights with a greater number of repetitions. The benefit of this approach to training is that it allows you to increase your strength on exercises. Conversely, if you shorten the amount of rest in between sets, you do not allow yourself as much recovery. It becomes more difficult to lift a given amount of weight. While this does not do as good a job of increasing strength, it does force the muscles to grow to adapt to the rest period.

Overload is not something that only needs to be applied on a daily basis, it must be applied over a lifetime of training. The final principle deals with the importance of applying overload logically over time.

## The Principle of Progressive Overload

Progressive overload involves two areas:

- The exercises that are employed in a training program; and
- The total amount of work that is done in a training program.

The exercises that are performed by an individual beginning his or her training career should be less complicated than one who has been training for a longer period of time. A beginner should be expected to master certain fundamental skills in the training program. Once those skills are mastered, they may be applied to more complicated exercises. Failure to master these skills may result in injury, wasted time in the weight room, and incomplete development. Two examples of learning fundamental skills before progressing to more complicated ones concern the back squat and the Olympic-style lifts:

- The back squat is typically learned before the front squat, overhead squat, or other variations. This is because the back squat teaches correct posture when squatting, foot placement, keeping the heels on the ground, squatting by pushing the hips back and then flexing the knees, ascending with the hips and shoulders moving up at the same speed, etc. If one does not possess those skills then the

front squat, overhead squat, pause squat, eccentric squat, etc., will be much more difficult to learn.

- Generally the Olympic-style lifts are learned from the top down. This breaks down a complicated exercise and makes it easier to master. For example, by learning the power clean initially with the bar above the knees, we learn to explosively extend the hips while shrugging the shoulders up and plantar flexing the ankles. We learn to receive the bar in a quarter squat and how to recover from that position. This is difficult to learn. Adding correct starting posture with the bar on the ground, lifting the bar from the ground to the knees, getting the bar around the knees, and then explosively extending the hips while shrugging the shoulders up and plantar flexing the ankles will prove too much for many to master initially.

In order to make gains from training over time, you must find a way to perform more work. This may be more weight lifted, more repetitions performed, more sets, or some combination of the three. As we discussed in the overload section, this is necessary to keep your body making adaptations. This also needs to be conducted with caution, as progressing too quickly can result in injury and burnout. The best way to do this is to apply some type of systematic approach to training. The one most commonly used is periodization of training, which essentially consists of breaking the training process down into smaller, more manageable units. Periodization is a way to organize your training over your career; this includes the weight lifted, the volume of work, the exercises employed, rest, recovery methods, etc. All of this is done in a way that ensures that you are in the best possible shape when it counts—during the competition.

The principles of exercise that this article has covered are very important for making sure that you get the most out of your strength and conditioning programs. Applying specificity means designing conditioning programs to elicit the development of desired qualities. Applying overload means that strength and conditioning programs will be difficult enough to be effective. Applying progressive overload allows for strength and conditioning programs to be effective over your training career.

### About the Author

*John M. Cissik, MS, CSCS is the Director of Wellness Services at Texas Woman's University. He also owns and operates Fitness and Conditioning Enterprises, which provides speed and agility instruction primarily to children and teens. He is the National Strength and Conditioning Association's State Director for Texas.*