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# Technique & Speed Development for Running

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Running speed is an important factor for success in athletics. Obviously in track and field events the fastest athlete will usually win the race, jump the farthest or throw the javelin the farthest (2). But speed is critical in almost every sport. Faster athletes will be able to get to the ball first, elude defenders, score, or catch the person with the ball more effectively. Running speed is so important that it is frequently used to evaluate athletic potential and to help in the selection of athletes for a team. While you will see that some aspects of speed are genetic, or inherited, there are certain things you can do to develop and improve your speed.

## What contributes to speed?

Before talking about how to improve speed it is important to first understand the factors that influence speed. As you might imagine, there are many things that impact speed, including:

- The structural make-up of your muscles,
- How well your muscles are able to use fuel,
- Flexibility,
- Fatigue,
- Stride length and stride frequency, and
- Technique.

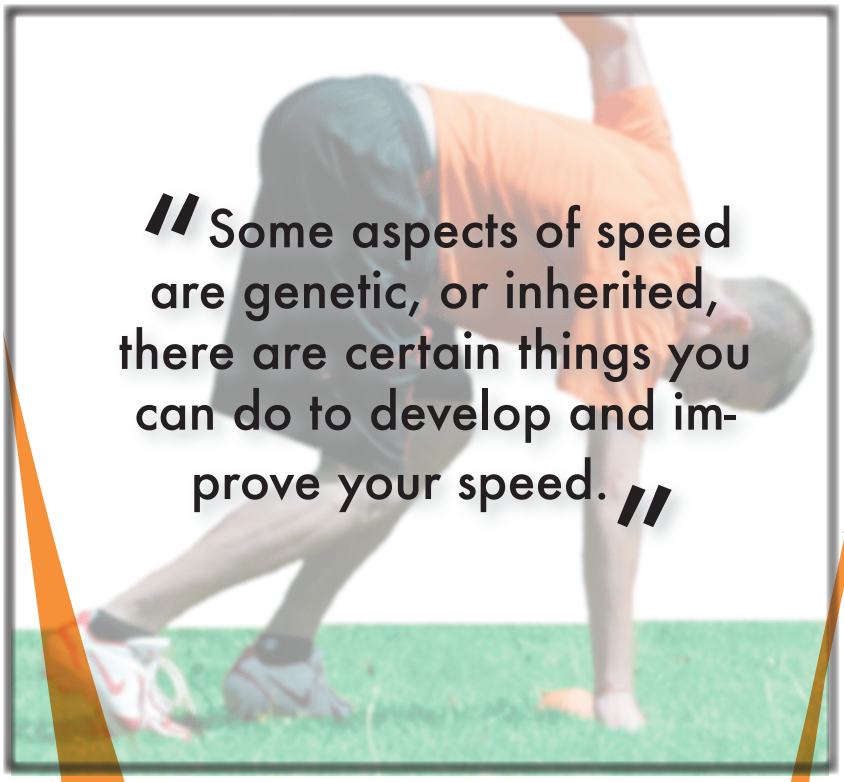
Let's look at each of these factors in a bit more depth.

### *Muscle Structure and make-up*

Muscles are made up of a combination of fast-twitch and slow-twitch fibers. Fast-twitch fibers contract rapidly and forcefully while slow-twitch fibers contract more slowly and with lower levels of force. However, slow-twitch fibers do not fatigue as rapidly as the fast-twitch fibers. Different muscles, even within the same athlete, will have different percentages of fast and slow twitch fibers. Similarly, every athlete will have different percentages of fast and slow twitch fibers in a given muscle. The fiber-type make-up and the length of the fibers in a muscle is an inherited quality. If all other things are equal, athletes with longer muscle fibers and a greater percentage of fast-twitch fibers should have the ability to run faster (5) than athletes with shorter slow twitch fibers.

### *Using fuel*

While muscle's architecture is genetic, its ability to use fuel is trainable. ATP (Adenosine Tri-Phosphate) is the substance that drives muscle contraction and there are three different "energy pathways" that the body can use to create ATP. These three systems are the creatine phosphate system (CP), the glycolitic/ anaerobic system and the oxidataive/ aerobic system.




The energy pathway that provides ATP for muscle contraction depends mainly on the intensity and the duration of the activity being performed. The CP energy pathway has the greatest impact on speed since it produces ATP rapidly, but only for a short period of time. Speed depends on how much ATP is on hand in the working muscles and on how much CP is available to create "new" ATP as it is used. The effectiveness of the CP system can be improved by making short, high intensity training a regular part of your running program..

### *Flexibility*

Flexibility is also important for speed development and injury prevention (1); it is important that the limbs be able to travel through a full range of motion without impediment to make the running movement fluid and efficient. To develop speed a runner should emphasize improving flexibility at the hip (the hip flexor and extensor muscles), the thigh muscles (hamstrings and quadriceps), and the muscles of the lower leg (both the calf muscles and the muscles at the front of the shin). While static stretching can be done, it is usually more effective to combine static stretching with dynamic stretching (stretching with movement). This will allow greater carryover to the running movement and speed development. Being flexible will also allow a runner to increase stride length and stride frequency (7), which will be discussed shortly.

### *Fatigue*

Muscle fatigue occurs after repeated contractions because ATP is depleted and metabolic waste products accumulate in the muscle. As you might imagine, fatigue interferes with a muscle's ability to contract and negatively impacts technique. Just as you would not want to perform Olympic-style lifts or lift heavy weights when fatigued, performing speed work under fatigued conditions will reinforce improper technique and possibly lead to injury. Teaching an athlete to run slowly or with bad technique will reinforce incorrect motor patterns. Speed work should be performed when the athlete is fresh so that they may learn good technique and run quickly. When fatigue sets in and performance of the exercises begins to suffer, the speed workout should be terminated for that day.

### *Stride length and stride rate*

Stride length refers to the distance a runner's center of mass travels with each stride (2). Stride frequency refers to the number of foot contacts that are made per unit of time. Both stride frequency and stride length directly contribute to running speed. Essentially, Speed = Stride Length x Stride Frequency. From this equation it should be obvious that speed will increase if an athlete is able to take longer strides while maintaining stride frequency, and vice versa. Both stride length and frequency are trainable. With this said, it is important to realize that you reach a point of diminishing returns if you increase your stride length too much. After a certain point, too long of a stride length will slow an athlete down because he will begin to experience braking forces (3). Newton's third law states that "for every action there is an equal and opposite reaction." When the foot hits the ground in front of the body the force generated by the ground is directed back towards the runner, effectively slowing him or her down. Elite sprinters, who have already optimized their stride length, focus on increasing stride frequency to improve their speed. For most athletes, the trick is to find the optimal relationship between these two variables.

### *Technique*

Finally, proper technique is paramount to performance, and poor technique is actually the limiting factor in most athletes' speed development. Good technique will allow a runner to move his or her limbs quickly and safely. Poor technique will result in poor movement efficiency, braking forces, and the overloading of certain muscles and joints that could possibly lead to injury. Technique is one of the most trainable components of speed work, especially with developmental athletes. The remainder of this article will focus on running technique. As technique is probably the most trainable and essential component mentioned above, the rest of this article will examine good running technique and outline drills to help develop an athlete's technique.

## Sprint Technique

According to Jarver (1978), speed performance will largely depend on the ability to improve the functioning of the nervous system and the coordination of muscles used to produce a movement pattern. The ability to coordinate muscle actions directly impacts technique. Failure to coordinate the muscles quickly and efficiently will result in slow speeds and possible injury.

For purposes of this article, we're going to divide running into two phases: the support phase and the recovery phase. Each leg has support and recovery phases. The support phase begins when the foot hits the ground and lasts until it breaks contact with the ground. The recovery phase begins when the foot breaks contact with the ground and lasts until it again makes contact with the ground.

In the support phase, the leading foot should land on the ground slightly ahead of the athlete's center of gravity (slightly in front of the hips). The foot should be driven down towards the ground by the hip extensor muscles; the hamstrings and gluteal muscles should be performing the majority of the work during the hip extension. The quadriceps (knee extensors) are also important at foot contact since they keep the athlete's knee from flexing excessively and dissipating elastic energy. As the foot contacts the ground it should be dorsiflexed, with the big toe pulled up towards the shinbone. This helps to maximize the amount of energy that can be stored by the calf muscles and then released to generate propulsion in a later phase of the running stride. The outside of the forefoot, not the heel, should contact the ground.

The athlete should then think about pulling him or herself over the support foot. The athlete should continue exerting force with the hip and knee extensors until his or her center of gravity passes over the support foot. At this point, the runner should focus on plantarflexing the foot (pointing the toes) with the calf muscles. When the toes leave the ground the support phase has ended.

As an athlete enters the recovery phase, the ankle should immediately be dorsiflexed with the big toe pulled up towards the shin. As the foot leaves the ground the athlete should flex the knee and bring the heel up towards the hips/ buttocks as quickly as possible. This helps to "make the leg shorter" and allows the athlete to swing the recovery leg forward faster than he or she could if the limb was kept straight during the recovery phase. Remember speed is what we are looking for, so even relatively "small" things like flexing the leg can help a runner gain valuable time in a race or competition.

As the heel is drawn towards the hip, the leg should be swung forward. The athlete should imagine they are trying to step over the opposite knee with the ankle. This will keep the leg "short" and speed high for as long as possible. As the ankle steps over the opposite knee the athlete should begin unfolding, or extending, the swing leg. It should be noted that the hip and knee extension that occur during this phase are due to a transfer of momentum, not an active contraction of the lower limb muscles (8). As the leg unfolds and the athlete prepares for the next support phase, he or she should focus on again activating the hip extensors to

drive the foot down towards the ground.

In addition to the lower body action, there are a few other pointers that an athlete should focus on. The first of these is posture. The athlete should run with the trunk erect. The head should be level and the hips should remain tall with very little vertical movement. Second, arm swing contributes to running speed. The athlete should focus on driving the arms both backwards and forwards to provide balance and generate momentum. The elbow angle should range from 60 degrees in front to 140 degrees in back (8) and the athlete should avoid swinging the arms across the midline of the body.

Obviously an athlete has to think about a lot of things going on in a short period of time when sprinting. This can be an overwhelming skill for many athletes to learn. Drills are a valuable tool and can aid the athlete in the learning and perfecting of specific running skills. Drills can help in the development of "ideal" sprinting technique and speed (9). Note that while drills are important in the development of technique, and while they serve as a useful tool in the warm up, they are not a substitute for actual running and sprint training. By definitions, drills are a part of the movement. Remember that the entire skill must be put together and practiced for an athlete to become faster.

## Sprint Technique Drills

The following technique drills will be described in this article:

1. Ankling,
2. Butt kicks, and
3. A drills.

### *Ankling Drill*

"Ankling" teaches an athlete how to lift the foot off the ground during the running motion. During ankling, the knees should remain straight. The athlete should step forward with the right leg with the foot dorsiflexed and big toe lifted up towards the shin. The outside of the right forefoot should contact the ground just in front of the athlete's center of gravity. The athlete should pull himself or herself over the foot. As the athlete's center of gravity passes over the right foot (i.e. when the foot is now behind the athlete), the foot should go into plantarflexion (pointing the toes and pushing off the ground) until it leaves the ground. As the right foot leaves the ground the ankle should immediately be dorsiflexed and the big toe should be lifted up in preparation for moving it in front of the athlete again. Begin practicing this drill with just the right foot for

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10-20 yards. Then perform it with the left foot. After the athlete is comfortable with this approach, have him or her perform this drill alternating between the right and left sides.

### *Butt Kick Drill*

"Butt kick" drills that are performed for running are slightly different than what most of us are used to. The goal of butt kicks is to teach the athlete to lift the heel up to the hips quickly during the recovery phase of running. The athlete should step forward with his or her right leg with the foot dorsiflexed and big toe lifted up and proceed through the support phase as was discussed in the ankling drill above. As the right foot leaves the ground it should immediately be dorsiflexed and the big toe should be lifted up. The heel should quickly be brought up to the athlete's hip. Note that as this is done the right knee will be lifted up. Unlike more traditional butt kick drills, the goal here is not to stretch the quadriceps, it is to practice getting the heel to the hips as quickly as possible. Initially this drill should be performed with the right leg for 10-20 yards. The athlete should then perform it with the left leg. After the athlete is comfortable with this approach, they should perform the drill alternating between the right and left sides.

### *A Drills*

"A drills" combine the skills learned through ankling and butt kicks and add the high knee action that is important for running. Focusing on the right leg, proceed through the foot contact and support phase as described in the ankling drill above. As the right foot leaves the ground it should immediately be dorsiflexed and the big toe should be lifted up. The heel should quickly be brought up to the athlete's hip. As the heel is brought to the hip, the leg should be swung forward attempting to lift the knee as high as possible. When the knee is in its highest position, the foot should still be dorsiflexed with the big toe lifted up. As the leg is swung forward, the leg will naturally start to "unfold". Once the limb has swung forward the athlete should drive the foot down, using the hip extensor muscles.

The athlete should practice this drill as a "walk," initially with the right side, for 10-20 yards. The athlete should then switch to the left side. When the athlete is comfortable with this, he or she should alternate between the right and left sides. When the athlete is comfortable with the A Walk, he or she can make it more difficult by performing the drill as a "skip." Initially the athlete should train first the right side, then the left. Once he or she is comfortable then they may alternate between the right and left sides (6, 7).

## Summary

Being able to run fast is extremely important for success in many sports. While many factors may be trained to help improve running speed, technique is one of the most trainable and one of the most important. Solid technique will result in a faster, more efficient runner. Poor technique will limit an athlete's speed. To help an athlete master the skill, the sprinting motion may be broken down into drills that train parts of the motion. Drills simplify a complicated skill, helping with mastery. They may also serve as warm up and conditioning exercises.

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