Run With More Muscle

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In its essence, running is a certain type of communication between the brain and the muscles. The brain sends electrical "motor" signals to the muscles, causing them to move in the exquisitely choreographed pattern we know as the running stride.

The muscles, in turn, send sensory feedback signals to the brain, which uses this information to modify the stride for greater efficiency, to change pace, to produce feelings of fatigue and so forth. To train for running is to practice this special type of communications between your brain and your muscles. Such practice improves these communications in ways that make you a stronger runner.

For example, training increases the number of motor units that your brain is able to access and use to contribute to running. (A motor unit is a bundle of muscle fibers that is fed by a single motor nerve.)

Some very interesting studies have shown how improvements in muscle performance derive from a simple boost in the amount of muscle tissue the brain is able to recruit during exercise -- an improvement that is completely independent of structural change in the muscles themselves.

For example, in one study, subjects engaged in a strength training program for the calf muscles of only one leg, while leaving the other leg alone. After six weeks, maximum voluntary contraction force was improved in both legs. The improvement in the untrained leg was clearly correlated with increased neuromotor output to it.

Increasing the number of motor units capable of involvement in the running stride -- or muscle activation potential -- carries a couple of benefits. First, it enables you to generate more force at key moments of the stride. There are moments of the stride when particular muscles are required to contract even harder than you can voluntarily contract them, using all of your strength while standing still.

Runners who can contract these muscles more forcefully at such moments will run better because of it. For example, a team of Finish researchers has shown that higher caliber runners generate stronger muscle contractions in the moment preceding footstrike, which results in a shorter ground contact time, which is directly linked to better performance.

Greater muscle activation potential also enhances endurance, due to a phenomenon known as motor unit cycling. During sustained running, your brain seldom activates more than 30 percent of the available muscle units simultaneously. However, it constantly changes the specific motor units it activates, allowing some to rest while others take their turn. By increasing the pool of muscle fibers capable of contributing to the stride, you increase the amount of rest opportunity for each and can then sustain any given speed longer before motor units begin to fatigue.

Experienced athletes have much higher muscle activation potential in their sport-specific movements than inexperienced athletes and non-athletes. Likewise, athletes of any experience level have a higher muscle activation potential when they are in peak shape than when they are relatively out of shape.

A beginning out-of-shape runner may only be able to activate 50 percent of his or her available motor units while sprinting at top speed, whereas a world-class sprinter in peak form will probably be able to activate closer to 80 percent.

The importance of increasing muscle activation potential

Increasing muscle activation potential should be a high training priority for relatively inexperienced runners and for every runner in the early stages of training for a peak race (that is, the base phase of training).

Every runner recognizes the importance of building aerobic capacity and endurance in the base phase of training by performing a gradually increasing volume of moderate-intensity workouts. This includes long endurance workouts of gradually increasing duration.

But equally important is training to increase the number of muscle fibers your brain is able to activate during running, because this is an equally significant performance limiter. First you need to increase the total amount of muscles you are able to use when running; then you can worry about increasing the "fitness" of your muscles.

How to increase muscle activation potential

To increase muscle activation potential you must perform very short, near-maximum-intensity efforts, such as 30-second hill sprints. Only when you demand maximum or near-maximum power production from your muscles does your brain begin to activate its least-preferred "fast-twitch" muscle fibers.

As you first increase the number of such efforts, you will complete workouts from week to week and then increase their duration and slightly decrease their intensity. This will enhance the endurance performance characteristics of the strength/speed specialist fibers and thereby make them vital contributors to your race-intensity efforts in the later training phases.

Following is a 12-week schedule of neuromuscular training workouts that are designed to:

- Increase your muscle activation potential during running
- Increase the endurance characteristics of the newly recruited fast-twitch muscle fibers.

Be sure to warm-up thoroughly before doing these high-intensity efforts and cool down afterwards. The 30-second hill sprints should be performed on the steepest hill you can find. The one-minute hill sprints may be done on a shallower hill and will necessarily be done at a slightly slower pace. All active recoveries are slow jogs. Every fourth week is a scaled-back "recovery week" to prevent overtraining. By the end of Week 12 you'll be ready to race -- with more muscle than ever!

Week 1	4 x 30-sec. hill sprints w/ 2-min. active recoveries
Week 2	6 x 30-sec. hill sprints w/ 2-min. active recoveries
Week 3	8 x 30-sec hill sprints w/ 2-min. active recoveries
Week 4 (Recovery)	6 x 30-sec. hill sprints w/ 2-min. active recoveries
Week 5	6 x 1-min. hill sprints w/ 2-min. active recoveries

Week 6	8 x 1-min. hill sprints w/ 2-min. active recoveries
Week 7	10 x 1-min. hill sprints w/ 2-min. active recoveries
Week 8 (Recovery)	6 x 1-min. hill sprints w/ 2-min. active recoveries
Week 9	3 x 3 min. @ 5K race pace w/ 3-min. active recoveries
Week 10	4 x 3 min. @ 5K race pace w/ 3-min. active recoveries
Week 11	5 x 3 min. @ 5K race pace w/ 3-min. active recoveries
Week 12 (Recovery)	3 x 3 min. @ 5K race pace w/ 3-min. active recoveries

Matt Fitzgerald is the author of several books on triathlon and running, including Runner's World Performance Nutrition for Runners *(Rodale, 2005).*