Sorely needed answers

As you grin and bear that exquisite post-exercise leg pain (delayed onset muscle soreness or DOMS) after Boston let's consider what you did, or didn't do, to deserve it and how to get back to your running sooner.

Many questions come to mind; "Why are my legs sore even after I trained so well?" "Why is it that after the race it is easier to climb the stairs than descend?" "What is the role of lactic acid in all this?" "Why does the pain seem to peak at about the 48 hour mark?" "Should I stretch or get a massage or just wait it out?" "What lingering damage may remain?" And, the vital one, "When can I get back to serious training again?"

In order to answer the questions about your soreness, three phases should be examined: your preparation, race day itself and recovery.

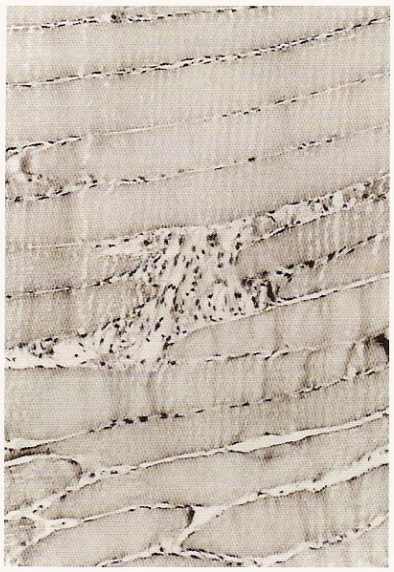
Specific Adaptation to Induced Demand (SAID)

First off let's address the preparation. Successful training involves the knife-edge separation of reaching your full potential or being injured. My countryman, the late great New Zealand coach Arthur Lydiard, experimented with the ultimate training distance per week back in the fifties and came up with an ideal of 120 miles. Most of us don't do anywhere near that (for various reasons) and still get injured.

Training involves physiological adaptation of the body to stress (SAID). Muscles change their internal composition both positively and negatively; the former building more mitochondria for energy production and undergoing microscopic damage that ideally repairs stronger; but also negatively building up unwanted adhesions between structures (shortening and stiffening) and increasing their tension and tone. Muscles may also weaken. Just compare your initial stride length to what can become 'the marathon shuffle' towards the end.

In between bouts of training this damage requires time to repair. Massage bodywork, combined with flexibility, strength and cross training can be useful to speed up recovery. Regular massage can also monitor *excessive* tissue damage and subsequently nip injuries in the bud. The more specialized Neuromuscular Therapy also addresses trigger point build up, possible nerve entrapment and postural distortion.

The eccentric ups and downs of hills



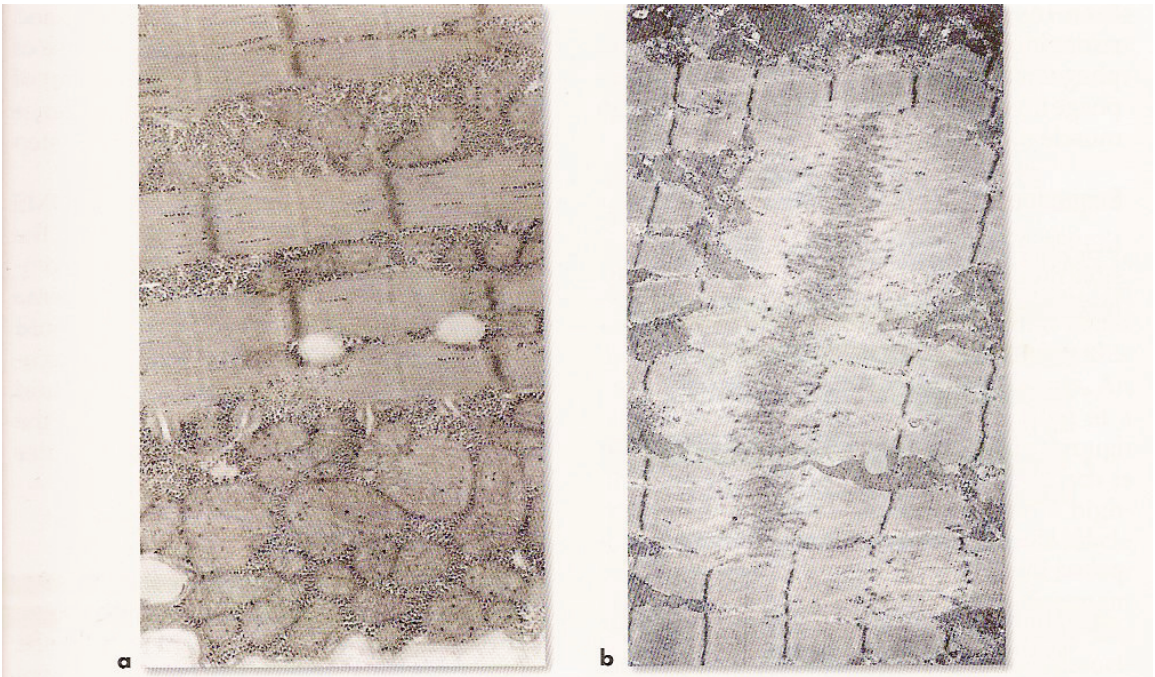
▲ **Figure 3.10** An electron micrograph of a muscle sample taken immediately after a marathon, showing the disruption of the cell membrane in one muscle fiber.

While training for a hilly marathon we often attack the uphill and jog the downhill. If you trained in the Rift Valley with the Kenyans you would have to attack the downhills too. This gravity resisting activity (like walking down stairs) makes muscles, e.g. quadriceps, lengthen as they contract and is called an eccentric contraction. Leg muscles trained eccentrically develop more contractile compartments called sarcomeres. It's like adding more bungee cords (another NZ invention) to help absorb the stress in each fiber. The downside is that training hard down hills increases the risk of injury, so you don't want to do too much of it.

Back in the '50s and '60s Lydiard trained his 'boys' regularly on a 22 mile course starting from his home in a range of hills called the Waitakeres in Auckland, NZ. It just so happened that the last 5-10 miles of this were mostly downhill, just at the time you were getting a little tired. Arthur's boys won many Olympic gold medals. It's interesting to note that Lydiard's training principles are quite similar to those Chris Carmichael used for Lance Armstrong, but that's another story.

Marathon-day muscle meltdown

On race day itself, physiological muscle adaptations are tested to the max. Natural stimulants (e.g. adrenalin) kick in for increased performance and endorphins kill much of the pain (runner's high). The demand for oxygen and nutrients often exceeds supply. Muscle cells rupture, enzymes freely abound, the muscle's sliding filaments distort and acidic wastes build-up (the ubiquitous lactic acid).



▲ **Figure 3.11** (*a*) An electron micrograph showing the normal arrangement of the actin and myosin filaments and Z disk configuration in the muscle of a runner before a marathon race. (*b*) A muscle sample taken immediately after a marathon race shows Z disk streaming caused by the eccentric actions of running.
Adapted from F.C. Hagerman et al., 1984.

The end results are edema (tissue swelling), necrosis (cell death) and a possible inflammatory process (albeit unresponsive to anti-inflammatory medicine) that tends peak at 48 hours. The exposed pain receptors sense all this and certainly let us know. Lactic acid is often blamed for muscle soreness but this is not the culprit because it's back to a normal level within an hour of finishing. Its high levels during the marathon itself may have caused damage though.

Rest and recovery

The traditional post-event massage should consist of **very** light, non-stimulating stroking on the legs in the direction of the heart for 10-12 minutes only. A big smooth chunk of ice can also be used to do the stroking and cool things down at the same time. Other recovery methods include repeated application of alternate warm and cold packs (or hot tea followed by beer, as commonly practiced). Whirlpools and spa baths seem to benefit as well, but cool is best.

Russian sports massage guru, Zhenya Wine, believes that post-event massage in the case of a marathon should occur 2-3 hours after finishing because of the extent of the damage and after the heart and breathing rates have stabilized. My own thoughts are that this delay acts like a second warm-down, because, seriously, who warms down with a gentle jog at the end of a marathon? Later, she advocates active non-weight-bearing exercise like aqua-jogging .

It's important to replenish muscle glycogen with some simple carbohydrate followed by complex carbohydrate followed by quality protein intake. Muscular protein breakdown has occurred, as described above, and after this a rebuilding process technically called "remodeling' occurs. If the building blocks are not quickly supplied to the spent muscle cells additional proteins may be broken down for energy use. A good nutritionist can advise the details on this.

In the long term it's believed that the effects of the marathon can linger for up to 12 weeks. Observable damage is certainly present for up to 21 days. During recovery massage bodywork will speed the delivery of nutrients by increasing circulation, softening the hypertoned tissue and clearing waste products. It is often a time to be careful but funnily enough there are some people who run another race a few weeks later and do a PR! Is it possible that they are stronger from all the repair processes incurred after the eccentric contraction damage from the marathon and have maybe peaked too late? Only one way to find out…

Stew Wild, a massage therapist originally from NZ, is now based in greater Boston and working at 360 NeuroMuscular Therapy in Needham, MA. He regularly teaches Neuromuscular Therapy (NMT) seminars throughout the US (www.nmtcenter.com) and NZ. His 8 marathons and 2 Ironmans seem unlikely to be added to – but you never know. Contact him at swild@360nmt.com.