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Elite Explainer

Answers to persistent puzzles in the world of running. BY RICK LOVETT

The London Olympics are winding down, and most of us have spent two weeks glued to the tube, listening to commentators explain everything from badminton to the modern pentathlon. But we may still have questions about Olympic-level competition in our own sport, distance running. Here's what the experts have to say about three questions that might have crossed your mind.

How can elites, moments after crossing the line, wave to the crowd and run a victory lap—when, in my best races, it's all I can do to stagger out of the chute?

Partly it's training, says American 5K record-holder Molly Huddle. "An athlete who trains as hard and specifically for an event as the elite athletes do can recover pretty quickly, even though the race still feels really hard," she says. "A minute or two later, they are usually OK to celebrate."

Matt Harber, an exercise physiologist at Ball State University, Muncie, Ind., agrees. "A lot of these athletes are training at such high levels that the race itself, in the grand scheme of what they're used to, is not that big a deal," he says. "It's not as physically taxing in regards to their capacities as it is for the rest of us."

The difference in training is particularly apparent in marathons, which, for the average person are basically a matter of getting to the finish line. "It's almost a survival issue," Harber says.

But it's also apparent in shorter races, such as the 10K. "Most of us bend over for a second or stagger for a few seconds, but then we are fine," says 2008 Olympian Amy Begley. "We are used to working hard for a long period of time and recovering quickly. Some of our workouts are 14 to 18 miles in length."

Training at such high levels also has psychological benefits. "Even as a physiologist, I will admit that psychology is probably more important for performance than physiology," Harber says. In particular, he says, the experience of high-level training makes athletes accustomed to the feel of working hard, making them less likely to think, "This is hard; I'm spent." And since they don't feel that way, they're less likely to act that way.

Not to mention that winning is itself emotionally powerful. "I think a bit of adrenaline kicks in," Huddle admits.

"You're so excited you forget how tired you are," adds Bob Williams, a coach in Portland, Ore. "When you have that added adrenaline, it overrides everything."

Not that this means these runners have made a miraculous full recovery 30 seconds after the race. They'll still feel the race later on. And, Begley says, "A funny thing most people don't know is that we can't sleep after a race."

Why does heat seem to bother (some) elites much less than the rest of us?

Heat tolerance too begins with training. "I notice a difference in [my] ability to tolerate heat when I am fit versus unfit from an injury or something," says Huddle. "Training allows the body to better deal with extra environmental stressors in a race."

She notes, however, "Some athletes still wilt a little in the heat."

This variability is partly due to genetics. The body's thermal regulation process is a balance between how much heat you generate and how much you can get rid of, Harber says, which means the best heat runners "are either not making as much heat, or they're really good at dissipating [it]."

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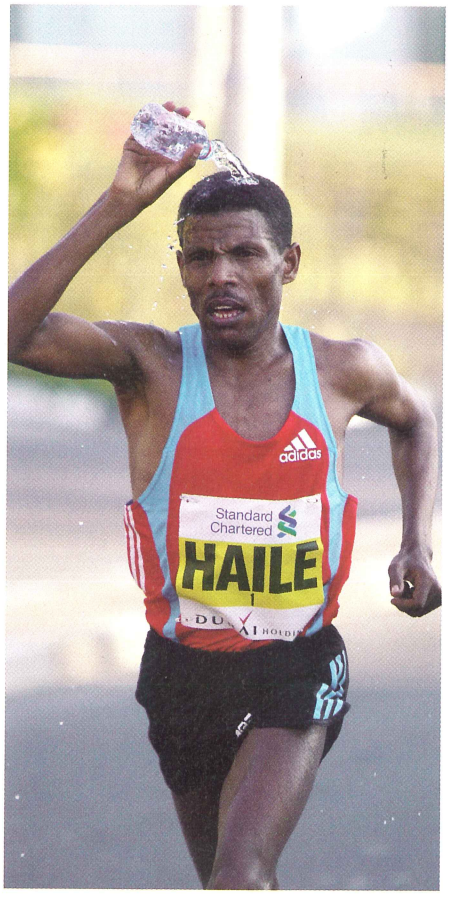

Photos: Victor Sailer/PhotoRun (2)

Elite

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Body size plays a critical role. Other than sunlight falling on your skin, heat is produced mostly in the muscles — and the amount you generate depends on how hard you're working. That, in turn, is a function of body size. "A bigger athlete will produce more heat than a lighter athlete," Harber says.

Heat is lost, however, through the skin. And, pound for pound, smaller runners have proportionally more heat-shedding surface area than do bigger ones — even if both are equally lean. What this means is that they not only generate less heat, but they cool much more efficiently.

In laboratory experiments conducted shortly before the 2004 Athens Olympics, South African exercise physiologist Tim Noakes had two groups of men, one group weighing 130 pounds and the other weighing 110 pounds, run 8K time trials on treadmills.

In cool temperatures, the two groups were about equal. But when the room temperature was jacked up to 95 degrees F, the smaller men were 45 seconds per mile faster than their larger counterparts. And if a 110-pound man sounds tiny, think again. "Elite marathoners are now down to about 119 pounds," says Harber. "[In heat], body size is a big issue."

Heat tolerance may also be related to where you live. If you've lived in a hot climate for a long time, Williams says, you may simply be better at knowing what you can and can't do under such conditions. "[Such runners] aren't as bothered by it because they live their whole lives in it," he says.

Nevertheless, it's possible, as Huddle notes, to improve your heat adaptation. Prior to the Beijing Olympics, Dathan Ritzenhein reportedly ran on a treadmill in an "environmental chamber" at the University of Oregon that could reproduce China's expected heat and humidity. "He would do workouts in there, even long runs," says Sean Coster, a coach and exercise physiologist at Oregon Health & Science University, Portland. "He [said] it was arduous, but look at his result in Beijing [where he was ninth, beating people with faster PRs]. He was probably one of the people who raced to the best of his ability in those conditions."

Physiologically, what training in heat does is to increase the efficiency of sweating. Partly that's by increasing the number of sweat glands used by the body. "You sweat over a greater amount of your body," Harber says. But heat acclimatization also causes runners to start sweating earlier on, before their core temperatures rise significantly. In essence, your body has learned to anticipate what's coming and starts cooling itself earlier on. "Most people think sweating means you're out of shape," Harber says, "but the better sweaters are [actually] in better shape."

In addition, your sweat becomes less salty, allowing the body to conserve electrolytes. Blood volume also increases — not due to an increase in oxygen-carrying red blood cells, but due to an increase in plasma. This slightly dilutes the oxygen-carrying capacity of your blood, but the extra blood volume more than makes up for it by making it easier for the blood to both carry oxygen to the muscles and move heat to the skin, in a process somewhat like the circulating water in a car radiator carrying heat out of the engine.

The extra blood volume also gives you more fluid to sweat away when needed. For most of us that's significant, because an old rule of thumb says you can only lose about 2 percent of your body weight before performance starts to drop.

But that rule is an average figure, and variations in it may be another of the reasons some people are more heat tolerant than others. A study in the May 2012 issue of the *Clinical Journal of Sports Medicine* found that in winning the 2009 Dubai Marathon, Haile Gebrselassie sweated out a stunning 9.8 percent of his body weight — enough to make most of us staggering wrecks.

The fact that Gebrselassie could not only keep moving at this level of dehydration, but also win, means that some people appear to have a much higher tolerance for dehydration than others do. If they also happen to be among Harber's "good sweaters," they may be able to run effectively in heat long after most of their competitors are fading.

Why do elites always wear spikes on the track, even for 10,000m? And if spikes are such an advantage, how come road racing flats aren't built similarly, with negative heels designed to put you "up on your toes"?

First, note that not all spikes are alike.

Historically, spikes were designed for traction on cinder tracks, like the one on which Roger Bannister ran his 3:59 mile in 1954. (As late as 1964, the Olympics were run on cinder tracks.)

Today's artificial tracks give better traction, but spikes are still of some benefit, particularly on turns, "which you do 50 times in a 10K," Huddle points out. "You gain a few seconds per mile due to the grip," Begley adds.

The rest of the shoe is designed mostly to hold the spikes, with as little weight as possible, with maybe a bit of cushion for the longer races.

What this means is that sprinters' spikes are negative-heeled (meaning they have a thinner heel than forefoot, opposite from ordinary training shoes). But the negative heel, per se,

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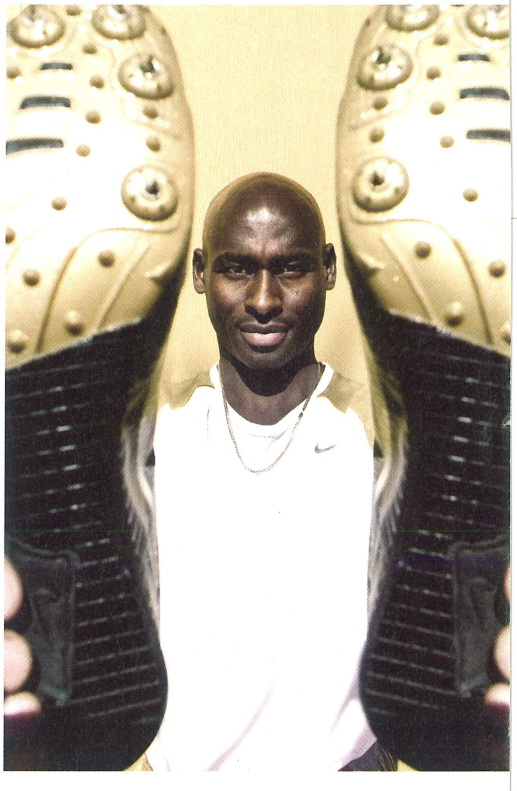

Photo: Peter Baker

Science of Sport

Roll On

Foam rollers improve flexibility without compromising power.

The Research: A study published in the May 2012 *Journal of Strength & Conditioning Research* measured knee range of motion and quadriceps strength in a small group of athletes. Some of the subjects did two one-minute foam rolling sessions on their quads, while the rest did nothing. All of the subjects were then re-measured for range of motion and strength, first two minutes after the second foam rolling bout, then 10 minutes after the second foam rolling bout. While the rolling didn't affect strength in any way, subjects who used the foam roller showed a 10 percent increase in range of motion two minutes later, and an 8 percent increase after 10 minutes.

The Advice: A bout of foam rolling shortly before exercise can be effective to increase your range of motion without any loss in muscular performance (such as has been shown to accompany static stretching). While foam rollers have long been used for recovery and to work on troubled areas, this study suggests packing a roller might also be a good way to warm up for a strong effort.

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is a consequence of spike design, not a deliberate target.

Negative heels do aid proper sprinting form. "Spikes encourage you to run more on your toes, which is good for shorter events," Huddle says. But even this is almost by accident. If you're sprinting with proper form, Harber says, your heel isn't touching the ground. You may need some cushion in the forefoot, but any buildup of the heel is excess weight that can be removed in order to make the lightest possible shoes. For the same reason, track shoes are also designed to be worn without socks, and some have cutouts in the heel fabric. If you're running races where every hundredth of a second counts, every gram of extra shoe weight matters.

The longer the race, however, the more strain this "up on the toes" style of running puts on the calf and Achilles, with little to no advantages. "I'm not aware of any performance advantage for a distance runner that comes from a negative heel," says Harber. Thus, even on the track, runners in longer events use neutral or even slightly positive-heeled shoes. "Rarely do [athletes] wear a negative-heeled spike unless it's 400m, 800m, or maybe 1500m," Williams says.

Thus, until sprints or middle-distance races start being contested on the roads, we're unlikely to see negative-heeled racing flats. While it's a matter of great debate these days, Harber argues that even shoes with zero heel lift would probably put too much stress on the calf and Achilles, excessively increasing injury risk in exchange for little, if any, gain in performance. Thus most racing flats, like most distance spikes, have a slight positive heel.

Another question might be whether today's new generation of minimalist road racing shoes might someday invade the track. Ray McClanahan, a Portland, Ore., podiatrist, thinks that at least one element should inform spike design. Even on the track, shoes need to allow runners' toes to splay out naturally, rather than confining them into a rigid, pointy box, he argues. In support, he cites an Olympic-level sprinter whose spikes have produced problems similar to those produced by pointy-toed dress shoes. "I think there'd be fewer injuries, and possibly better performances as well," he says. RT

runningtimes.com/sept12
Watch for a video of Phil Wharton demonstrating the patellar tendinitis release technique.

Wharton's Simple Solutions no. 2

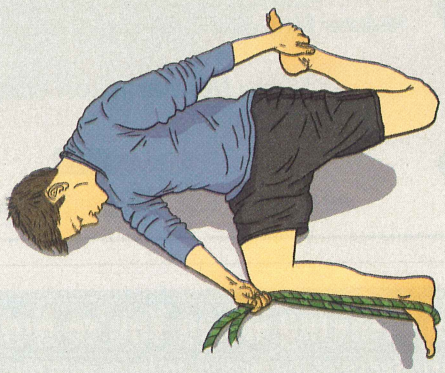
PATELLAR TENDINITIS

Dreaded words that every runner has heard: "You'd better stop running or you'll blow your knees out!" "Runner's knee," common to nearly anyone who has hit the road, carries dire warnings and fear. Patellar tendinitis – one of a cluster of conditions that make up what is called "runner's knee" – generally manifests itself as pain on top of the kneecap.

WHAT IT IS

Patellar tendinitis is an inflammatory reaction at the attachment of the patellar tendon into the patella, a sesamoid bone that floats on top of the knee joint. The floating nature of this bone means that it's particularly vulnerable to the stability, integrity and flexibility of the surrounding region, especially under the stresses that the area is subjected to during the impact-oriented activity of running. Lack of flexibility in a muscle/tendon unit increases these loading effects.

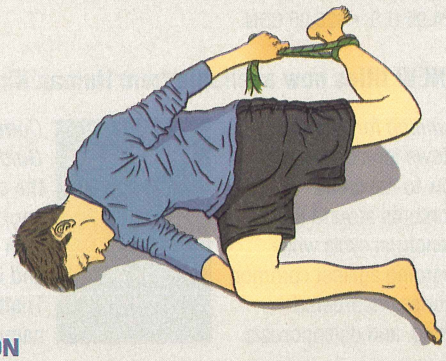
In addition to working on strength and flexibility throughout the leg, the following exercise releases the rectus femoris – a main quadricep muscle in the front of the thigh and a key connector to the patellar region.



RESET IT!

POSITION #1

Lie on your side in a fetal position; bring both knees up to a 90-degree angle. Place a rope around the arch of your bottom foot. Hold the bottom leg in position with your bottom hand on the rope. Place your top hand on your top ankle. Contract your abdominals. Stay forward on your bottom hip to avoid arching your back. Fully engage your hamstring and gluteus maximus (butt) muscles to bring your top knee as far back as you're able, moving to your natural end range of motion. Gently assist with your top hand on your ankle. Exhale as you perform the exercise, and inhale as you return to start position. Repeat for 8–10 reps.



MODIFIED POSITION

If your knee is too inflamed to close the angle of the knee joint, or you can't reach your ankle with your top hand, loop your rope around your top ankle. Keep your top or exercising leg at a 90-degree angle. Complete the exercise as described above, using your hamstring and glute muscles and gently assisting (not yanking) with the rope at your natural end range of motion. Exhale as you perform the exercise. Inhale as you return to start position. Repeat for 8–10 reps.

Illustration: Dan Hanafin