BY
MICHAEL BEHAR

PHOTOGRAPHS BY
HENRY LEUTWYLER

BAREFOOT RUNNING STUMBLES

The irresistible promise: Ditch your padded sneakers and run faster with fewer injuries. So why is the minimalist running craze causing maximum pain?

THE 2011 L.A. MARATHON WAS GOING WELL FOR JOSEPH GABRIEL. After 26 miles enduring a cold rain and gusty winds, he was still on pace to break four hours—his goal after four months of training. But as he turned onto Ocean Avenue in Santa Monica, with the finish line in sight 300 yards away, he felt a sudden tug above his left ankle.

"It wasn't painful; it was more like a pulling sensation. I thought it was a muscle," Gabriel recalls. "I had no idea what had happened and didn't want to make it worse." So he stopped—and the crowd went nuts. "Everyone was yelling my name—it was printed on my race bib. They shouted, 'It's right there, keep going!' And I'm like, 'But I can't walk!'" So Gabriel hopped the final stretch on his good leg. Time: 4:02:44.

Prop styling: Jocelyne Beaudoin/Art Department

Gabriel had ruptured his Achilles tendon. It took three months of rest and rehab before he could run again, gingerly. His physical therapist, Darwin Fogt, M.P.T., wasn't surprised by the injury—and not because his patient was 50 years old. To Fogt, Joseph Gabriel was yet another victim of the so-called barefoot running craze.

Gabriel didn't run (and finally hop) the L.A. Marathon barefoot; he trained and raced in a pair of minimalist running shoes—the kind with a nearly level heel, or "lower drop" in athletic-shoe parlance. He was one of legions of runners who'd read the bestselling book *Born to Run*, about Mexico's Tarahumara, an indigenous tribe whose members compete in races of 100 miles or more in flat sandals—and almost never get hurt.

In the book, author Christopher McDougall blames spongy shock-absorbing shoes for breeding runners with poor form and weak feet. McDougall, who also wrote about the Tarahumara for *Men's Health* in 2006, visited Harvard University, where he met Daniel Lieberman, Ph.D., an evolutionary biologist who studied gait mechanics. Lieberman showed that when barefoot runners land forefoot first—in front of the arch—their gait is measurably less jarring than shod runners who hit the ground with their heels. In January 2010, with the popularity of *Born to Run* soaring, the journal *Nature* put Lieberman's research on its cover.

"Lieberman's publication, McDougall's book—it was a perfect combination of events," says Matthew Silvis, M.D., a sports medicine physician at Penn State who teaches barefoot technique. Shoemakers rushed to meet the new demand, introducing lighter, flatter shoes with names like Bare Access and Minimus. Glovelike footwear called FiveFingers or Skeletoes became popular. "Barefoot running" became shorthand for the minimalist movement.

"People assumed that if you could run barefoot, your injuries would go away."

But now Dr. Silvis, who is studying injury rates among barefooters, says he is seeing an alarming number of foot stress fractures, calf tears, and Achilles strains in runners transitioning to barefoot or minimalist running. Fogt, president of Evolution Physical Therapy in Culver City, California, concurs. He says he finds plantar fasciitis in the majority of his barefoot runners, compared with perhaps 15 percent of traditional runners.

Fogt's client, Gabriel, admits that he bought into the craze. "I drank the Kool-Aid," he says. "I just thought I should do it because of what I had heard, even though I was having no problems with what I was using at the time." The promise of a more efficient stride was irresistible: "I got the new minimalist shoes, threw out my old ones, and out the door I went."

LIGHTWEIGHT SHOES CAN MAKE A RUNNER feel faster; and with no initial pain, a new convert to minimalist running is tempted to log miles as he always has. For Gabriel, months of high-mileage training without proper conditioning (see "Save Your Achilles") added strain to his hamstrings, calves…and Achilles tendons. It's not just older guys who are at risk; Fogt sees people of all ages with injuries related to barefoot-style running. Dr. Silvis is currently treating a 20-year-old elite distance runner with a history of stress fractures who tried a barefoot approach in an attempt to ease the shock to his tibia bones. But, says Dr. Silvis, he "straightaway ran at his normal distance and intensity, and subsequently fought Achilles difficulties for weeks."

That's typical, says Nathan Koch, P.T., a physical therapist based in Scottsdale, Arizona. "Runners are always trying to get faster, looking for an edge," he says. "They're also always hurt. And when they're hurt, they want answers. So people made assumptions that if you could run barefoot, your injuries would go away."

In May, researchers at the University of Wisconsin at La Crosse published a study demonstrating that a forefoot or midfoot landing—the usual technique in lighter shoes with a less cushioned heel—increases the load per step on the Achilles tendon by 11 percent compared with a heel landing. That's about 7,000 extra pounds of force over a mile for a 150-pound runner, says study author John Willson, Ph.D., now an associate professor of physical therapy at East Carolina University. That kind of force, says Fogt, is the reason anyone who's making the switch from conventional shoes to minimalist footwear needs an extensive training period to ready the foot for barefoot style. "And not everyone's foot is able to tolerate barefoot running, even with the training period," he says.

Neither McDougall nor Lieberman asserted that barefoot running had any proven benefit over shod running. Lieberman merely demonstrated that forefoot strikers are, quite literally, lighter on their feet. He also observed from habitually barefoot cultures—he visited the Kalenjin tribe in Kenya—that human anatomy is innately suited for running.

The problem? "People took our paper, which was about a very small, limited topic, as telling them how to run," Lieberman says. "Running is a complex skill that you can't learn how to do just by taking off your shoes."

LET'S REVIEW WHAT WE DO KNOW. "WE HAVE 26 bones, 33 articulations, 111 ligaments, and 20-plus muscles in each foot," says Irene Davis, Ph.D., P.T., director of the Spaulding National Running Center at Harvard Medical School. Davis has authored more than 100 papers on unshod running mechanics. Our feet, she says, "were truly designed to run without shoes, and we were likely designed to run throughout our lives. We evolved in a way that allowed us to run for survival, such as hunting for food, but we may not be meant to run the long distances that many modern runners do."

Blindfold a barefoot runner and he's still able to detect infinitesimal changes in surface texture, temperature, and slope. Neuroscientists have a name for this ability: proprioception. Habitually unshod people, such as the Daasanach and Kalenjin people of Kenya—or the San of Botswana, who hunt shoeless across the scorching sands of the Kalahari Desert—are keenly proprioceptive. "All those sensory nerves in our feet are there for a reason," says Lieberman. "They tell us how our bodies interact with the ground."

Fossil evidence suggests that early humans used some type of foot protection as far back as 30,000 years ago. No matter. Most likely it would not have provided enough cushioning to encourage heel striking when running fast and for long distances on hard surfaces. As Lieberman says, "It's just going to hurt. And because pain is an adaptation, it means running that way is probably not a good idea."

But footwear evolved to the point where, according to a 2013 study of runners at the Milwaukee Lakefront Marathon, 94 percent of runners are heel strikers. So the appealing logic of barefoot-style running—more efficiency, less pain—had a ready audience. "But you can't take a foot that's been cushioned and protected and supported and just go out and run barefoot," says Davis. "It's no different than going to the gym and lifting a hundred pounds when you haven't been lifting. You've got to give your body, your soft tissues, your bones—the entire musculoskeletal system—time to adapt."

A hasty transition to barefoot or barefoot-style shoes, paired with a sudden shift in running form (from heel to forefoot), is likely to end badly. Gabriel is convinced that his abrupt switch was a contributing factor to his injury. Martin Pavelic, a 29-year-old marathoner who was a medical student at Penn State, sought out minimalist shoes because of his persistent back, knee, and foot pain. After a 1-mile test run in them, landing on his forefoot, "I got significant plantar fasciitis and was done running for a month."

Neither Gabriel nor Pavelic discussed their changeover with a physical therapist, physician, or trainer. "I definitely didn't do enough research—really just some stuff online," Pavelic says. "I didn't realize at the time how slowly it had to be introduced to avoid injury."

A survey of 785 runners in the *Journal of Strength and Conditioning Research* found that 80 percent were interested in minimalist technique; 22 percent tried barefoot, and 30 percent tried minimalist shoes. Of those, only 7 percent consulted experts. The rest turned to friends, the Web, or books (the most often cited was *Born to Run*) or simply did nothing.

And yet a third of the runners who tried running barefoot or in minimalist shoes cited injury prevention as a factor in making the switch. The truth is, no scientific study exists that correlates barefoot running with fewer injuries. Dr. Silvis, the Penn State researcher, tracked 20 barefoot converts for over a year and says they often just swapped one set of afflictions for another, especially if they didn't follow transition advice. "When we recruited them, they were all in conventional shoes and were barefoot or minimalist virgins," he says. "They had a history of tibial stress fractures, shin splints, patellofemoral knee pain"—injuries that plague shod runners. "After the transition, we didn't see the tibial stress fractures, shin

YOUR NEW GOLDEN GAIT

Quicker steps mean a lighter stride. Use a metronome to find your ideal beat.

You may run more efficiently—and faster—by adopting a shorter, quicker stride. In a study from the University of Wisconsin at Madison, runners who increased their step rate—also known as turnover or cadence—by just 5 percent reduced the load on their knee joints by 20 percent. (A step rate increase of 10 percent led to a 34 percent easing.) You'll avoid overstriding onto your heel and bouncing too high, says study author Bryan Heiderscheit, P.T., Ph.D. His running clinic has helped people reduce lower-back pain, IT band soreness, and Achilles tendon pain. Start with 5 percent, and gradually step it up. Here's how.

DOWNLOAD THIS

Smartphone apps, such as Very Simple Metronome (free, Android), can help you hit your desired cadence as you run. Another app, Cruise Control: Run ($5, iPhone) can speed up or slow down the tempo of your playlist music to match your target stride rate.

FIND YOUR BASE

Jump on a treadmill and warm up for a half mile at a comfortable pace. For 30 seconds, count the number of steps you take with one foot; then multiply that number by 4. That's your normal cadence; adjust the tempo of your metronome to match.

CRANK THE DIAL

Turn the metronome speed up 5 percent—if your normal cadence is 160, aim for 168—and match your turnover to the beat. You should notice that your steps become lighter as your strides shorten. This way you're reducing impact without really pushing it.

GO IT ALONE

Try this: Run for a minute or two at that 5 percent increase, and then turn off the metronome. A minute later, count your steps and see if you've maintained the tempo. You won't always run at that 168 pace, but you should be in the 166-to-170 range. –BRIAN DALEK

Illustrations by BOBBY McKENNA

splints, or knee pain. Instead we saw metatarsal stress fractures and Achilles and calf problems—the injury pattern switched."

No surprise there, says Mark Cucuzzella, M.D., a doctor, marathoner, and unshod enthusiast who teaches clinics on running form. "The bottom line is, running causes running injuries," he says. "Not shoes, not barefoot. Running. If you don't want a running injury, don't run."

HARVARD'S LIEBERMAN IS AN AVID BAREFOOTER but trains in a variety of shoe types or nothing at all. In an essay for *Exercise and Sport Sciences Reviews* published in April 2012, he made an important distinction. "Barefoot running per se is neither more nor less injurious than shod running, because what matters most is how one runs, not what is on one's feet." He concludes, "Taking off one's shoes to run is no panacea."

In fact, it's cadence—how rapidly your feet hit the ground—that appears crucial. A study in *Medicine & Science in Sports & Exercise* showed that quicker, shorter strides lead to "a substantial reduction in energy absorption at the knee and hip." Your joints get hammered less.

Lieberman insists that he never said barefoot is better, "or that you have to forefoot-strike, or that's the only way to run, or that all forefoot strikers are free of injury. You can run well in army boots." But he thinks all runners should try barefoot: "It's a useful training tool."

Other experts agree. But take it slow, cautions Koch of Endurance Rehab. "Do a few laps around a soccer field and then stop." Even better, stick to the gym for a few weeks, logging a half mile or less on a treadmill; then do drills that promote joint stability, like rope jumping, walking lunges, high knees, side shuffles, and bird steps. Calf drops, Koch says, "are critical for the gastrocnemius and soleus muscles, the hamstrings, and the Achilles." Also, jog in place and try shifting your gait onto your forefoot.

With practice, soon you'll improve your form instinctively. "Runners need to learn how to land like a cat," Dr. Cucuzzella says.

Does this mean we're all born to run on our forefeet? Koch doesn't think so. "There's no one perfect gait. It's not possible," he says. "Everybody has their own unique set of genetics and history and posture." Lieberman's work in Kenya showed that unshod Kalenjins used a forefoot strike predominantly. But three out of four barefooters in another tribe, the Daasanach, are heel strikers, according to researchers at George Washington University.

A proper forefoot strike is like "running on butter," Lieberman says. Then again, "There's nothing wrong with heel striking. But if you're going to do it, buy a shoe that protects you."

Dr. Silvis has created a program at Penn State called Barefoot Essentials that focuses on body alignment and posture, foot control, and something he describes as "reaching softly." Pavelic, the student with plantar fasciitis, switched back to heftier shoes, began Dr. Silvis's system, and returned to minimalist. "But it took over a year and a half to truly transition," says Pavelic.

It worked: He ran the Philadelphia Marathon in minimalist shoes and is now injury-free. In California, Gabriel settled on a shoe between barefoot and conventional. He recently ran a hilly half marathon in Pasadena and is training for November's New York City Marathon.

For his part, Lieberman is certain we were born to run. "People want to be told how to run, and the answer is nobody knows," he says. "It would be like telling you what you're supposed to eat or how you should make love to your wife. There is no one answer. It's complicated. We're still trying to figure it out." ■

RAMP UP YOUR KNOWLEDGE

Drop, or ramp angle, refers to the difference in height between your heel and forefoot. The lower the drop, the more "minimal" your experience. Here are some shoes that can't miss—unless you run too far, too soon. –B.D.

0 mm
Extreme
Vivobarefoot Evo Lite
0.2 mm drop, 8.3 oz, $130, vivobarefoot.com

<4 mm
Minimal
Skechers GOrun Ride 2
2.9 mm drop, 8 oz, $80, skechers.com

4 to 8 mm
Transitional
Saucony Cortana 3
6.1 mm drop, 9.3 oz, $150, saucony.com

8 to 12 mm
Average
Mizuno Wave Sayonara
8.7 mm drop, 8.5 oz, $120, mizunousa.com

>12 mm
Cushy
Nike Air Pegasus+ 30
13.8 mm drop, 10.2 oz, $100, nike.com

SAVE YOUR ACHILLES

Switching to a forefoot landing or minimalist shoes can stress your Achilles tendon. Avoid disaster with a smooth, safe transition.

START SLOWLY
Runners who make the transition too quickly increase their risk of foot injuries, including stress fractures, a study in *Medicine & Science in Sports & Exercise* showed.
DO THIS Wear minimalist shoes for only 10 percent of your mileage at first. If you typically run 20 miles a week, run just 2 miles in minimal shoes. Do it at the start of your run, before you tire. Then continue in your other shoes, says Nick Campitelli, D.P.M., a podiatrist in Akron, Ohio. Increase by only 10 percent a week.

PERFECT YOUR FORM
Form drills can help fix imbalances as you recruit muscles needed for minimalist running.
DO THIS Standing tall, raise one knee 90 degrees to hip height and swing your opposite arm as if in a running position. Keep your other knee slightly flexed. Do fast "switches" of your legs—drive each knee up but don't bounce. Lean forward slightly and keep your head and center of mass still. Performing this drill for one minute prior to running teaches you to bounce less, easing the force of impact, says Ray McClanahan, D.P.M., a podiatrist based in Portland, Oregon.

STRENGTHEN YOUR FOOT
Your lower calf and the muscles surrounding your toes are underused with a heel strike, but a forefoot landing forces them to work harder, says Campitelli.
DO THIS Take a minute and do 20 standing calf raises in your bare feet. Concentrate on distributing the weight on your entire forefoot, forming an arch and gripping the ground with your toes. Do 100 calf raises throughout the day to strengthen your calf and foot muscles. –B.D.

MATT RAINEY (shoes), GalleryStock (runner)