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SECTION J

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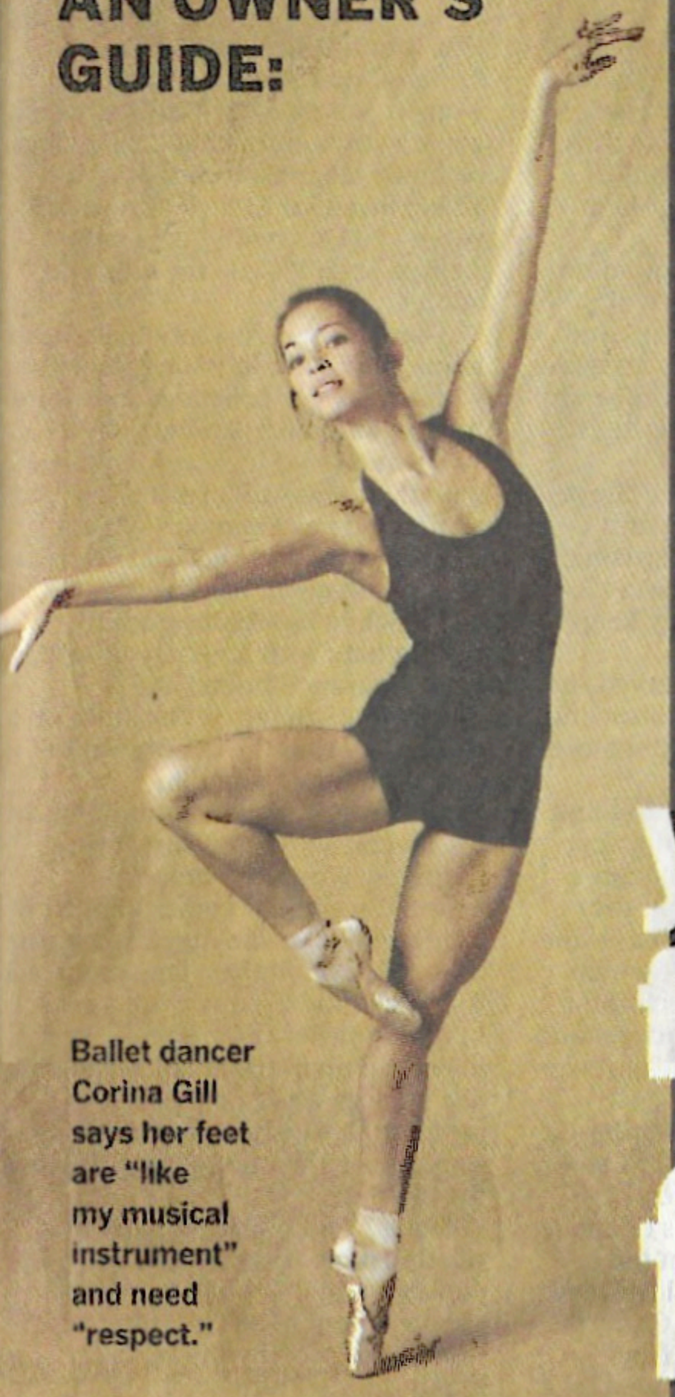
AN OWNER'S GUIDE:



Ballet dancer Corina Gill says her feet are "like my musical instrument" and need "respect."

your fabulous feet

Your foot is an engineering marvel – supporting your body in so ma conditions – but it requires care and conditioning to keep it healthy.

Professional soccer player Peter Vagenas says resting his feet is sometimes as important as working out.

BY SUSAN BRINK
LOS ANGELES TIMES

With its 26 bones and 33 joints, the foot is a biomechanical masterpiece.

"There's something wonderful about it," says Dr. Nancy Kadel, professor of orthopedics and sports medicine at the University of Washington. "It's a flexible shock absorber, then it's a rigid platform that propels you forward. It adapts to sand when you walk on the beach. Climb onto rocks to look at the tide pools, and it drapes over the rocks."

But as close as it is to perfection for locomotion, two modern environmental necessities stand in the way of allowing it to maintain its full nature-given glory: hard surfaces and the shoe.

For a walker, and more so for a runner, a steady diet of concrete asks a lot of that magnificently springy arch. By forcing it flatter, it shifts balance unnaturally, the effects being felt all the way through the foot, ankle, leg, hips and back. Add a pair of shoes for the toes to bump against, the heel to blister against, and you've got the potential to adversely affect almost every bone, muscle and ligament in the body.

SEE YOUR FABULOUS FEET, J4

LOS ANGELES TIMES / RICARDO DEARATANHA

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Your fabulous feet

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It took millions of years for the foot to assume its present shape, a shape it's held for millions more years. The rest of the body has adapted, finding its center of gravity over the spaced left, right footprints of walking, the straighter, in-line footprints of running. But the foot and its attached body parts have had mere thousands of years to adjust to a steady diet of cobblestone, wood surfaces and sandals — not to mention the relatively recent introduction of concrete, asphalt, loafers and stilettos.

To see what's happened in the evolution of the foot over several million years, try the old trick used to teach kids their left from their right hand. Stick the thumbs out as the back of the hand faces you. The one that forms the "L" is the left hand.

Now try it with your feet. Humans, who have an opposable thumb but a big toe that lines up with the other four, can't do it, haven't been able to do it for maybe 4 million to 6 million years.

The big toe, once sticking out to the side to help our hominine ancestors climb trees and grasp branches, eventually took its place in the lineup of toes, stabilizing the foot and allowing us to walk upright.

Not that the other toes don't matter. The baby to the middle piggy stand in a rigid line from heel to the toe tips, giving people support when standing still. The other two toes are loose, aiding in balance.

THE EARLIEST EVIDENCE that feet were ready to support us on their own, without help from the front paws, are the Laetoli footprints, a trail left by three human ancestors taking a stroll on two feet almost 4 million years ago. They walked together on soft ground, intermittently covered by volcanic ash and rain, leaving behind a bipedal record that hardened like a plaster of Paris science project. The footprints were discovered in Tanzania in 1976 by a team led by paleoanthropologist Mary Leakey.

Another clue to how long humans have been upright is provided by the fossilized remains of Lucy, discovered in Ethiopia in 1974. Her remains are from about the same time as the Laetoli footprints, give or take half a million years. But the bones in Lucy's wrists, according to research by scientists Brian Richmond and David Strait of George Washington University, suggest that, while she herself didn't walk on all fours, she retained some of the bone structure that allowed for knuckle walking. Bones from her wrists, the researchers found, remained rigid enough to help support her body on all fours.

Gaps in the fossil record don't allow for pinning down exactly when hominids stood up and walked on two feet. "Estimates vary, but most experts would put this transition at about 6 million years ago," says Thomas Greiner, professor of anatomy and physical anthropology at the University of Wisconsin at LaCrosse.

That's about when our human ancestors made the biological commitment to give up the advantages of an opposable toe for the alternative advantages of having two hands free to hunt and gather. "I think the human foot is essentially an organ that was designed first for grasping, but that has been modified for support and propulsion of the human body," says Greiner.

THE MODIFICATIONS HAVE resulted in a functional work of art, one foot sharing with the other the weight of daily living.

"It's a linkage system," says Dr. Carol Frey, director of West Coast Sports Medicine Foundation in Manhattan Beach, Calif., and assistant clinical professor of orthopedics at the University of California, Los Angeles. "One joint moves, and the others move. It allows you to balance on uneven terrain. It can adapt to jumping, landing and things as intricate as dancing."

Those adaptations spin off the basic, but complicated, process of walking. With each of the 2,000 steps required to cover a mile, when the heel first hits the ground, the mid-foot collapses slightly, the arch helping to absorb the shock of the impact. As the walker rolls to the middle of the foot, ideally from the outside toward the ball, the foot flattens more. The toes bend to push off. Off the ground again, the arch springs back, aided by the non-rigid, unlocked big and second toe, providing more energy to the forward propulsion and getting the foot ready for the shock of the next landing.

"The design of the human foot allows for more energy rebound than any shoe can," says Frey.

When people start to pick up the pace, say faster than an eight-minute mile, they land more toward the middle of the foot. Sprinters often run entirely on the balls of their feet. "When your heel hits the ground walking, your foot needs to be supple to absorb the shock — even more so when running," says Dr. Nelson SooHoo, professor of orthopedic surgery at UCLA. "Then it transforms into something very rigid to get you off the ground."

NOT ALL FEET ARE CREATED EQUAL, what with high, normal or flat arches, wide or narrow widths, and differences in flexibility.

But most experts now believe that an athlete, a dancer or a soldier can excel with their natural-born feet, no matter what their shape. What gives great athletes and performers an advantage probably has more to do with muscles throughout their bodies — not to mention passion and discipline.

The flat foot, once all that was required for a 4F deferment from the draft, has been given the go-ahead for military duty, thanks in part to studies showing it is no more prone to injury than other types of feet.

Flat, normal or high arch, a flexible foot is a healthy foot. Any foot can increase flexibility with simple stretching exercises. They include walking on the beach and picking up sand with the toes, using bare feet to pick up one marble at a time, or scrunching a towel with bare toes.

The foot was one of the last things added to the human body in evolution, and it's still evolving, says Frey. Though the normal foot has 26 bones, some people might have an extra one or two, most commonly near the heel.

"I can't tell you if they're more evolved, or less evolved," she said. Maybe the extra one isn't necessary, and the owner's multigenerational offspring will lose it. Or maybe it's a new bone evolving, perhaps some day to give future people extra speed or bounce.

IT IS THE SHOES, says Greiner, that are responsible for the slight difference seen in the footprints of modern human beings when compared with the 4-million-year-old footprints of our ancestors in Tanzania.

"The Laetoli footprints are very similar to the footprints of humans today," he said. With one exception: Modern humans from industrialized countries have less space between the big toe and the other four toes. That difference is not seen when the ancient footprints are compared with the footprints of people today who live in parts of the world where shoes are not required — evidence that it's shoes, not evolution, responsible for the change.

"You and I and people who grow up wearing shoes have deformed feet," says Greiner. "Any parent will tell you that kids outgrow their shoes faster than they can buy them." And every time a child wears a shoe that's just a bit too small, they're undergoing what amounts to a minor foot binding, pushing that big toe closer to the others.

If that constant, minor binding continues, the foot begins to take on the shape of the shoe, leading to the many woes of the foot: corns, bunions, hammertoes.

"The vast majority of those problems are environmental," SooHoo said. "People with foot problems develop them from shoe wear."

Shay Murphy, of the University of Southern California basketball team, tapes her ankles during games.

Tim McIntyre regularly performs calf raises to strengthen his Achilles tendons.