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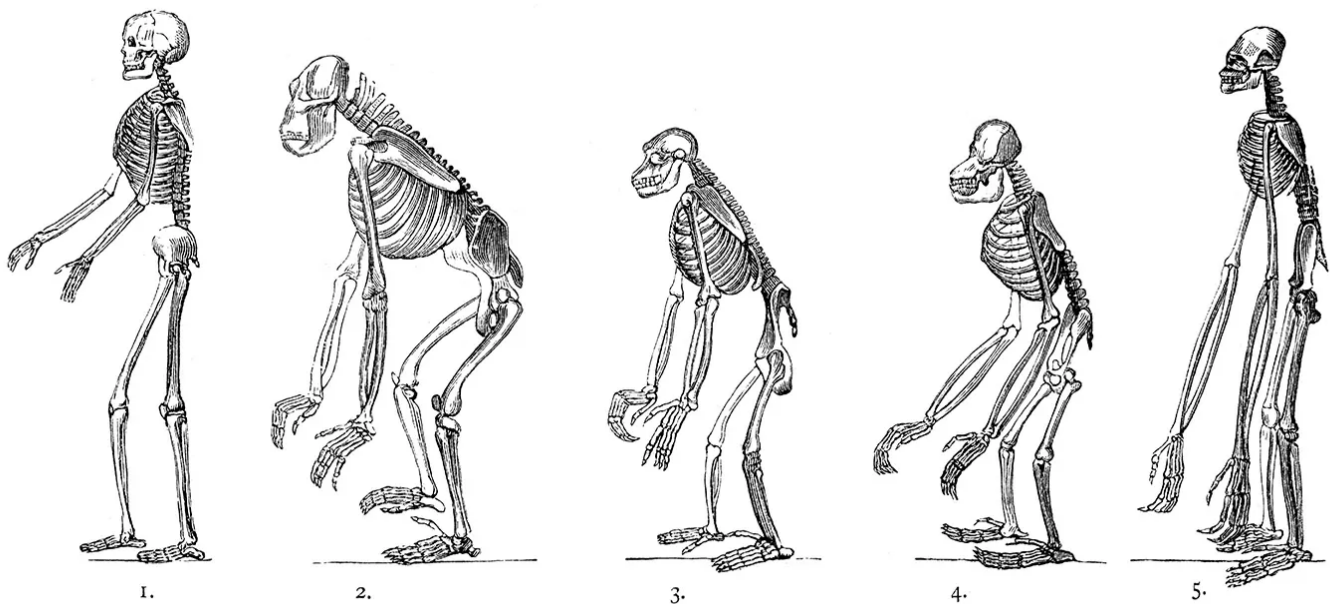
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NEWS

ANTHROPOLOGY

Two tiny genetic shifts helped early humans walk upright

Changes in gene activity reshaped our ancestors' hips, laying the foundation for bipedalism



Skeletons of a human, gorilla, chimpanzee, orangutan and gibbon stand next to one another in this anatomical sketch. Scientists have uncovered two genetic shifts in humans that differentiate the pelvis from those of our primate relatives, allowing us to walk upright.

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By **Roberta McLain**

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Two small genetic changes reshaped the human pelvis, setting our early ancestors on the path to bipedalism, scientists say.

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ists say.

One genetic change [flipped the ilium](#) — the bone your hands rest on when you put them on your hips — 90 degrees. The rotation reoriented the muscles that attach to the pelvis, turning a system for climbing and running on all four legs into one for standing and walking on two legs. The other change delayed how long it takes for the ilium to harden from soft cartilage into bone, evolutionary biologist Gayani Senevirathne of Harvard University and colleagues report in the Sept. 25 *Nature*. The result: a distinctive bowl-shaped pelvis that supports an upright body.

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While nonhuman primates can walk upright to some extent, they typically move on all fours. The newly identified changes to human pelvic development were “essential for creating and shifting muscles that are usually on the back of the animal, pushing the animal forward, to now being on the sides, helping us stay upright as we walk,” says coauthor Terence Capellini, a Harvard evolutionary biologist.



The researchers examined tiny slices of developing pelvic tissue from humans, chimpanzees and mice under a microscope, and paired those findings with CT imaging. Human ilium cartilage grows sideways, not vertically as it does in other primates, the team found. What's more, the cartilage transitions to bone more slowly than in nonhuman primates and in other human body parts. Together, these shifts allow the pelvis to expand sideways and maintain its wide, bowl-like shape as it grows.

A genetic analysis linked the shifts to biological on-off switches that control gene activity. In humans, cartilage-forming genes turned on in regions of the growing ilium that prompted the bone to grow horizontally. Bone-forming genes turned on later and in different spots, delaying the hardening process and letting the cartilage expand sideways. The extra growing time helps shape the short, wide pelvis that gives humans stability on two legs.

Because developmental genes are largely the same across primates, the team infers that the gene rewiring activity happened early in the hominid lineage, after humans diverged from chimpanzees. The findings reinforce a central idea in [evolutionary developmental biology](#): Big leaps in anatomy often come from subtle changes in the timing and location of gene activity rather than from entirely new genes.

“What Terry and his lab’s work has shown is that it’s not just a rotation, it’s a different way of growing,” says anthropologist Carol Ward of the University of Missouri in Columbia. “One of the most significant things about this change is it shows how critical it was to establish the ability to stand on one foot at a time, which lets us walk on two feet.”



The team's research didn't begin as an evolution story. Funded by the National Institutes of Health, the scientists were studying how the pelvis and knees form to better understand hip disorders. "It was geared towards biomedical research," Capellini says, "understanding how you build a pelvis and why it's different [from other primates and mice], and more importantly, why it leads to disease."

Ironically, the changes that made walking possible might also have made our hips more vulnerable to osteoarthritis, which is far more common in humans than in other primates.

The changes may also have had another unexpected knock-on effect, Capellini speculates. Wider hips could have paved the way for a roomier birth canal that later allowed for [the evolution of larger-brained babies](#). "It's an interesting kind of theoretical question," he says, "but it could actually have been a practical facilitator of future brain evolution."

CITATIONS

G. Senevirathne et al. [The evolution of hominin bipedalism in two steps](#). *Nature*. Vol. 645, September 25, 2025, p. 952. doi: 10.1038/s41586-025-09399-9.

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