Bipedal humans came down from the trees, not up from the ground (w/ Video)

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A detailed examination of the wrist bones of several primate species challenges the notion that humans evolved their two-legged upright walking style from a knuckle-walking ancestor.

The same lines of evidence also suggest that knuckle-walking evolved at least two different times, making gorillas distinct from chimpanzees and bonobos.

"We have the most robust data I've ever seen on this topic," said Daniel Schmitt, a Duke University associate professor of evolutionary anthropology. "This model should cause everyone to re-evaluate what they've said before."

A report on the findings will appear online during the week of Aug. 10 in the research journal Proceedings of the National Academy of Sciences .

The research, led by post-doctoral research associate Tracy Kivell, was supported by the Natural Sciences and Engineering Research Council in her native Canada, General Motors' Women in Science and Mathematics, and the University of Toronto, where Kivell did her Ph.D. work.

The debate over the origins of human bipedalism began during Charles Darwin's lifetime and continues vigorously to this day, commonly dividing into two competing models, the researchers explained.

One model "envisions the pre-human ancestor as a terrestrial knuckle-walker, a behavior frequently used by our closest living relatives, the African apes," they wrote in the PNAS report. The other model traces our two-legged walking to earlier tree-climbing, a mode of locomotion that is used by all living apes.

Supporters of the knuckle-walking origin think we and African apes evolved from a common knuckle walking ancestor. That connection, they contend, is still evident in wrist and hand bone features shared by African apes and by fossil and living humans.

But Kivell found otherwise when she began comparing juvenile and adult wrist bones of more than 100 chimps and bonobos, our closest living primate kin, with those of gorillas.

Significantly, two key features associated with knuckle walking were present in only 6 percent of the gorilla specimens she studied. But she found them in 96 percent of adult chimpanzees and 76 percent of bonobos. In all, she looked at specimens from 91 gorillas, 104 chimps and 43 bonobos.

Kivell and Schmitt suggested that one explanation for the absence of these features in gorillas is that they knuckle-walk in a fundamentally different way from chimps and bonobos. Gorillas stride with their arms and wrists extended straight down and locked in what Kivell called "columnar" stances that resemble how elephants walk. By contrast, chimps and bonobos walk more flexibly, "with their wrists in a bent position as opposed to being stacked-up," she said. "And with their wrists in bent positions there will be more stresses at those joints."

As a result, chimp and bonobo wrists have special features that gorillas lack -- little ridges and concavities that serve as "bony stops" to keep their wrists from over-bending. Gorillas don't need those, she added.

"When we first got together to work on this study that (difference) really jumped out in living color," Schmitt said.

"Then we sat down together and asked: 'What are the differences between them?' Schmitt said. "The answer is that chimps and bonobos spend a lot of time in the trees. And gorillas do not."

Chimpanzees and bonobos have a more extended-wrist way of knuckle-walking which gives them added stability on branches, the researchers concluded. In contrast, gorillas' "columnar" style of knuckle-walking is consistent with ground transport.

Indeed, "from what we know about knuckle-walking among wild populations, gorillas and adult chimpanzees will both knuckle-walk about 85 percent of the time that they're moving," Kivell said. "But chimpanzees and bonobos are more arboreal than gorillas. So they're doing a lot more of it in the trees."

Kivell and Schmitt think this suggests independent evolution of knuckle-walking behavior in the two African ape lineages.

Some scientists point to features in the human anatomy as our own vestiges of a knuckle-walking ancestry. One notable example is the fusion a two wrist bones that could provide us extra stability, a feature we share with gorillas, chimps and bonobos.

But some lemurs have that feature too, and they do a variety of different movements in the trees but do not knuckle-walk, Kivell said.

Altogether, the evidence leans against the idea that our own bipedalism evolved from a knuckle-walking ancestor, the pair wrote. "Instead, our data support the opposite notion, that features of the hand and wrist found in the human fossil record that have traditionally been treated as indicators of knuckle-walking behavior in general are in fact evidence of arboreality."

In other words, a long-ago ancestor species that spent its time in the trees moved to the ground and began walking upright.

There are no fossils from the time of this transition, which likely occurred about seven million years ago, Kivell and Schmitt said. But none of the later fossils considered to be on the direct human line were knuckle-walkers.

Source: Duke University (news : web)