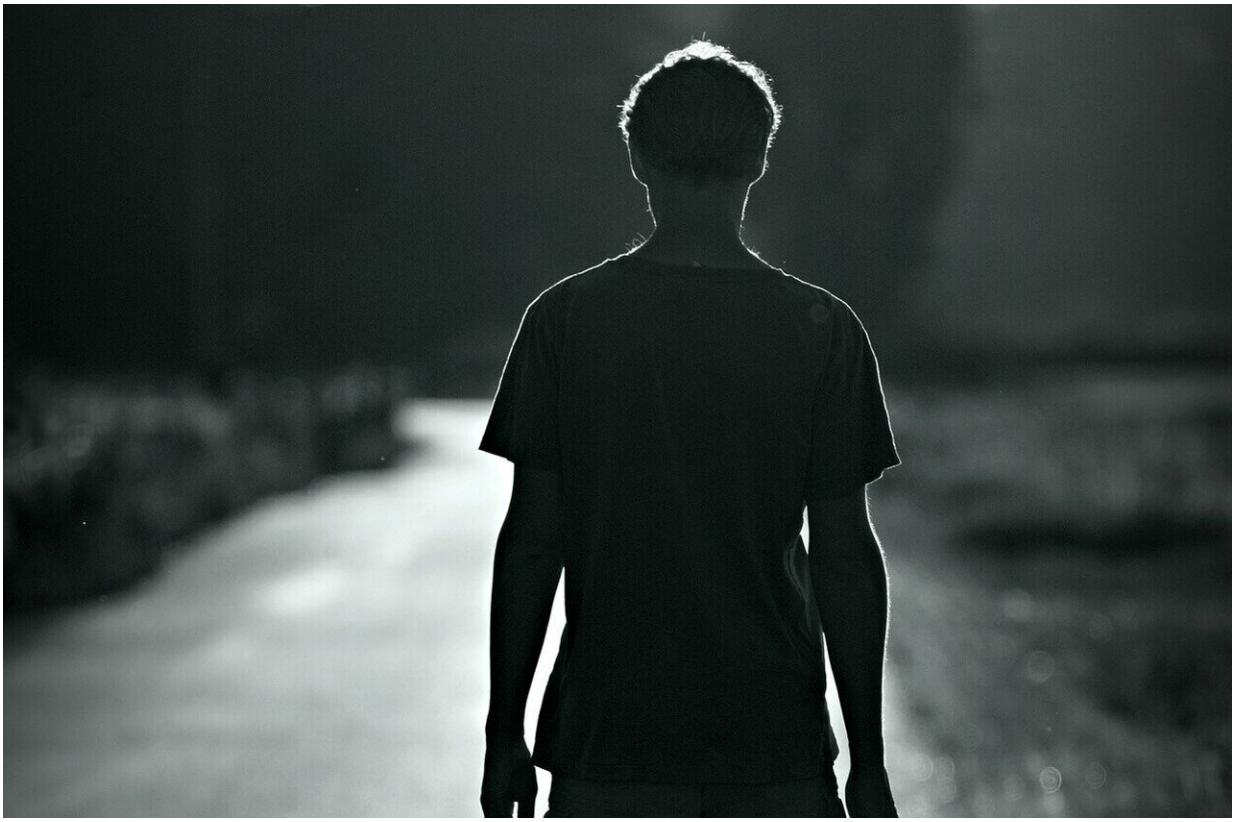
Multiple ways to evolve tiny knee bone could have helped humans walk upright

September 10 2024



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The evolution of bones in primates' knees could have implications for how humans evolved to walk upright, a new study has found.

Researchers from King's College London analyzed the presence of the lateral fabella, a bone in the knee the size of a sesame seed, in 93 different species of primates. The findings are published in the journal *Proceedings of the Royal Society B: Biological Sciences*.

They found that while most primates have these bones, they are often absent in hominoids, the group of primates that humans belong to alongside chimpanzees, gorillas, gibbons, and others.

Yet humans have evolved to have this bone differently from most primates and it is not found in all people. The researchers say this distinct evolutionary pathway of the fabella in humans could point to an evolutionary change that helped the ancestors of humans walk upright.

Dr. Michael Berthaume, Reader in Engineering at King's College London and author of the study said, "Our study shows that this often-misunderstood bone could have evolved in multiple ways in primates, with humans having a distinct form of evolution that began right at the start of all hominoids.

"Using this bone in a new way could have helped early humans, like Australopithecus, go from walking on all fours to walking upright."

The lateral fabella is a sesamoid bone behind the knee which is twice as common in people with knee osteoarthritis. Sesamoids, like the kneecap, are small bones embedded in tendons or ligaments that are sometimes present within mammalian skeletons, which means they can be absent in some mammals, but present in others of the same species.

Despite hundreds of years of research, little is understood in terms of sesamoids evolution, development, and why they are present in some people and not others.

In the new study, scientists used statistical modeling to examine the presence of three sesamoid bones in the knee—the cyamella, medial fabella and lateral fabella—using research published over the last one hundred years.

The scientists discovered that primates with faballae were 50 times more likely to have ancestors who also had them. The team also found that the medial and lateral fabella almost always develop in pairs, except in rare cases like humans, who only have a lateral fabella.

Further analyses suggest hominoids may have evolved a way to grow fabellae different from other primates, which could explain why humans can grow a lateral fabella without a medial one, but other primates cannot. This could unite over a century of research, where scientists have debated how these bones evolved.

The distinct evolutionary pathway of the fabella 're-emerging' in humans could point to an evolutionary change that helped the ancestors of humans walk upright.

Dr. Berthaume said, "In almost all other cases apart from humans, we know that primates developed fabellae in pairs. We also know that the way primates move doesn't necessarily affect the evolution of these bones, so why are humans different?

"Excitingly, this 'decoupling' could be the sign of an exaptation, when something in the body already exists and then begins to be used for another purpose—in this case bipedalism. Further work on the biomechanics of the fabella is needed to confirm this, but preliminary results are promising."

More information: The evolution of the knee sesamoids in Primates: A systematic review and phylogenetic meta-analysis, *Proceedings of the*

Royal Society B: Biological Sciences (2024). DOI: 10.1098/rspb.2024.0774. royalsocietypublishing.org/doi …
.1098/rspb.2024.0774

Provided by King's College London