Little Foot's inner ear

MicroCT scans of the hominin fossil known as Little Foot shed light on how she lived and moved, more than three million years ago

The inner ear of hominin fossils has the potential to provide valuable information about how an individual moved, what its hearing capacities were, and how the evolution of the species relates to others.

Based on microCT scans performed at the Evolutionary Studies Institute at the University of the Witwatersrand, a Wits scientist and colleagues have been able to 'virtually extract' the inner ear of Little Foot, the *Australopithecus* fossil dated at 3.67 million years old. Dr Amélie Beaudet, Professor Ronald Clarke and their team published a description of the inner ear in the *Journal of Human Evolution* in January. They also compared it with 17 hominin specimens from Sterkfontein, Swartkrans and Makapansgat belonging to the genera *Australopithecus, Paranthropus* and *Homo* and dating between three and 1.8 million years ago, as well as with 10 chimpanzees and 10 modern humans.

Overall, Little Foot's inner ear has both ape-like and human-like features, because the inner ear canals and the cochlea provided different results. The semicircular canals in Little Foot's inner ear are different from both modern humans and from *Paranthropus* – a genus of extinct hominins that lived at the same time as the first humans. The *Paranthropus* canals have a very specific shape that is not shared with any of the fossil specimens.

"By contrast, we found that the Little Foot inner ear canals are close to those of chimpanzees," says Dr Beaudet, lead researcher of the study. "They differ from modern human inner ear canals in that modern humans' canals evolved for unique activities such as running."

The study also shows a large diversity in the shape of the inner ear canals among *Australopithecus* species, which could suggest a high degree of variation in locomotor behaviour in this group.

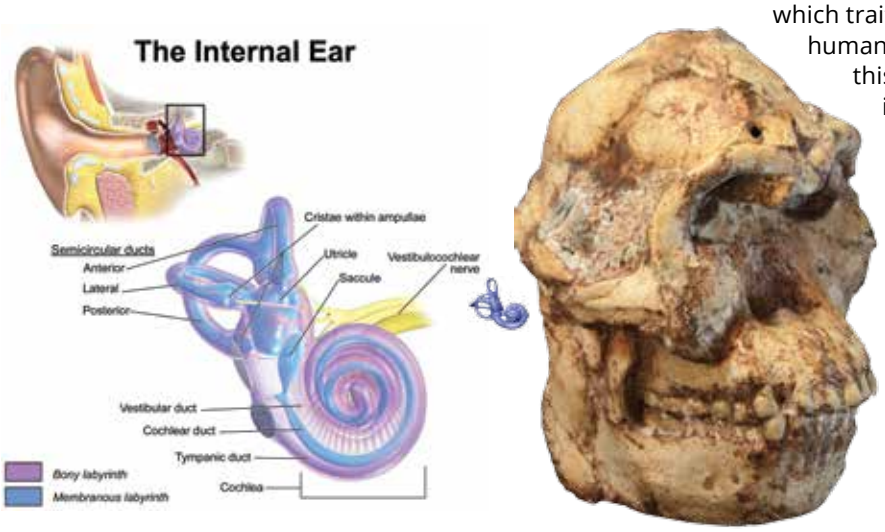
"Our analysis of the inner ear might be compatible with the hypothesis that Little Foot and the *Australopithecus* specimens in general were walking on two legs on the ground, but also spent some time in the trees," says Dr Beaudet. Little Foot's cochlea, though, is quite similar to other *Australopithecus* specimens in the study and to *Paranthropus*, but it differs with fossil *Homo* specimens. "This organ is related to sound perception and to ecological factors such as diet, habitat or communication, which means that Little Foot differed in this regard with early members of our own genus, implying some difference in behaviour," says Dr Beaudet.

The dimension and shape of the cochlea are related to the range of frequencies that can be detected by a species. The shape of the cochlea of fossil *Homo* specimens is compatible with an extended low-frequency hearing limit. This was not the case for *Australopithecus*, including Little Foot, nor for *Paranthropus*.

"At the moment, we are not yet sure what this means. It may be that the early *Homo* species had to extend their range of frequencies for adapting to a different environment or perhaps even to communicate to each other. We don't really know."

Of all the comparisons of Little Foot to other specimens, the greatest similarity in the overall inner ear pattern was with a specimen of similar age from the Jacovec Cavern in the Sterkfontein Caves.

"Having a reference point, such as comparing Little Foot to the Jacovec specimen, is important in detecting which traits are specific to us – humans – and whether humans evolved more distinct characteristics. With this finding we now would be able to know what is specific to *Homo* and *Paranthropus*, and when these features emerged in the fossil record," says Dr Beaudet.



Blausen Medical: Wikimedia

The semicircular canals (balance system) and cochlea (hearing organ) of Little Foot's inner ear differ from those of modern-day humans.

Issued by Wits University. Read about Little Foot's discovery in Quest Vol. 14 No. 1 (2018).

A longer article by Dr Amélie Beaudet was published online in January: https://theconversation.com/virtual-images-reveal-secrets-of-an-ancient-fossils-brain-and-inner-ear-108349

It includes a 36-second video animation of the virtual reconstruction of Little Foot's brain and inner ear, which can also be viewed at: https://vimeo.com/306999133