

Researchers discover clues on how giraffe neck evolved

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The third cervical vertebra of the modern giraffe. This species underwent both stages of elongation, which are responsible for its extremely long neck. Credit: Nikos Solounias

Scientists have long theorized that the long neck of modern-day giraffes evolved to enable them to find more vegetation or to develop a specialized method of fighting.

A new study of fossil cervical vertebrae reveals the evolution likely occurred in several stages as one of the animal's [neck vertebrae](#) stretched first toward the head and then toward the tail a few million years later. The study's authors say the research shows, for the first time, the specifics of the evolutionary transformation in extinct species within the giraffe family.

"It's interesting to note that that the lengthening was not consistent," said Nikos Solounias, a giraffe anatomy expert and paleontologist at NYIT College of Osteopathic Medicine. "First, only the front portion of the C3 vertebra lengthened in one group of species. The second stage was the elongation of the back portion of the C3 [neck](#) vertebra. The modern giraffe is the only species that underwent both stages, which is why it has a remarkably long neck."

The study, which includes a computational tracking model of the evolutionary elongation, is published in *Royal Society Open Science*.

Solounias and Melinda Danowitz, a medical student in the school's Academic Medicine Scholars program, studied 71 fossils of nine extinct and two living species in the giraffe family. The bones, discovered in the late 1800s and early 1900s, were housed at museums around the world, including those in England, Austria, Germany, Sweden, Kenya, and Greece.

"We also found that the most primitive giraffe already started off with a slightly elongated neck," said Danowitz. "The lengthening started before the giraffe family was even created 16 million years ago."



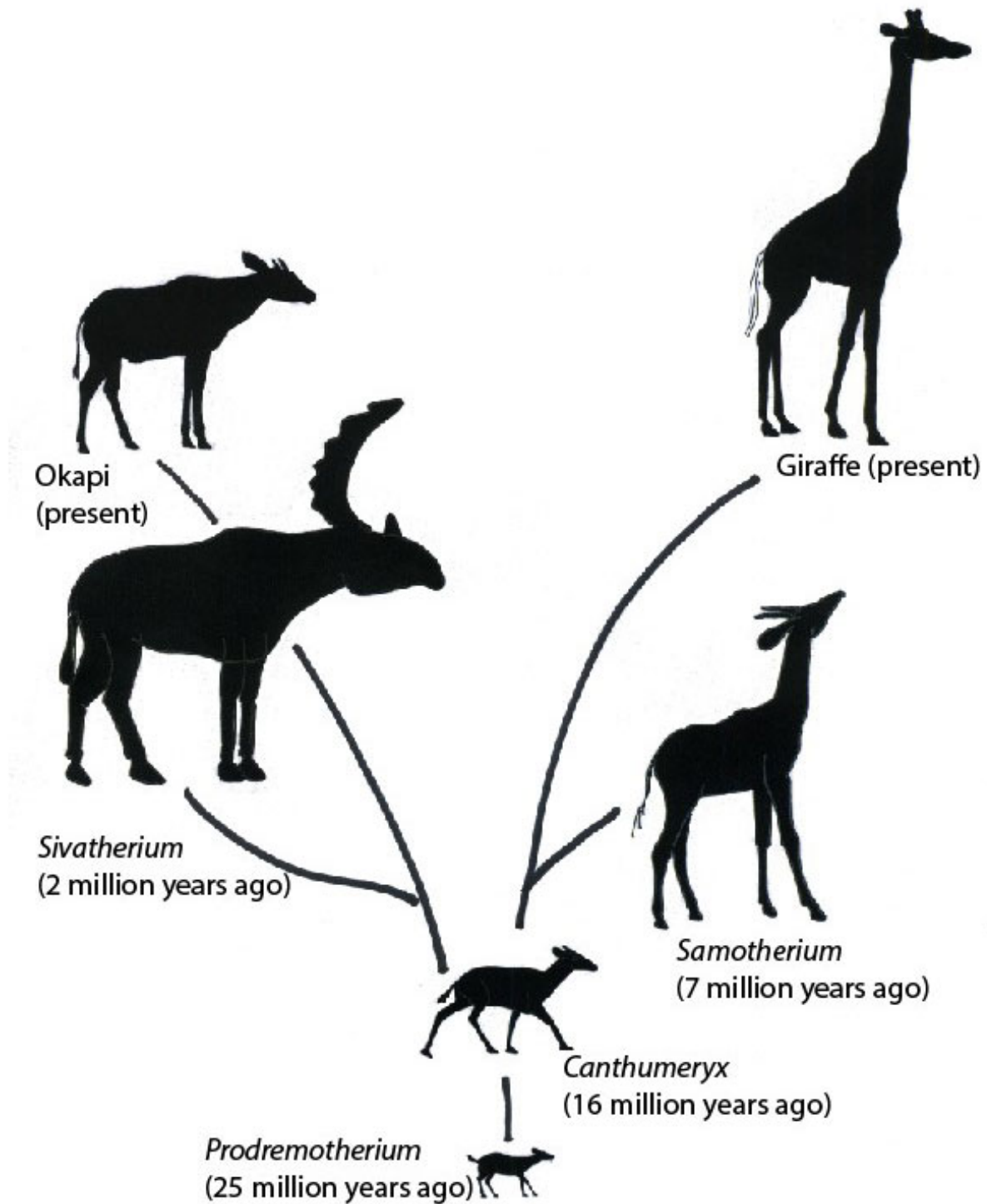
Fossil third cervical vertebra of *Samotherium*, an extinct giraffid that lived around 7 million years ago. This species underwent the first stage of elongation, but not the second stage. Credit: Nikos Solounias

But the main discovery came after the researchers analyzed anatomical features of the various fossils and compared them to the evolutionary tree.

"That's when we saw the stages playing out," said Danowitz.

Solounias and Danowitz found the cranial end of the vertebra stretched initially around 7 million years ago in the species known as *Samotherium*, an extinct relative of today's modern giraffe. That was followed by a second stage of elongation on the back or caudal portion around one million years ago. The C3 vertebra of today's giraffe is nine times longer than its width—about as long as an adult human's humerus

bone, which stretches from the shoulder to the elbow.



An illustration of neck elongation and shortening within the giraffe family.
Credit: Nikos Solounias and Melinda Danowitz

As the modern day giraffe's neck was getting longer, the neck of another member of the giraffe family was shortening. The okapi, found in central Africa, is the only other living member of the giraffe family. Yet, rather than evolving a [long neck](#), Danowitz said this [species](#) is one of four with a "secondarily shortened neck," placing it on a different evolutionary pathway.

The researchers next study area is the evolution of the giraffe's long leg bones.

More information: Fossil evidence and stages of elongation of the *Giraffa camelopardalis* neck , *Royal Society Open Science*, [rsos.royalsocietypublishing.org ... /10.1098/rsos.150393](https://royalsocietypublishing.org/doi/10.1098/rsos.150393)

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