Article of the Week: Standing tall: Gene Analysis Finds Clues to the Giraffe's Long Neck By Washington Post, adapted by Newsela staff on 05.26.16

Giraffes: They're weird.

Their long necks and short bodies are examples of how animals adapt to their environments during the process of evolution. Giraffes' bodies are short to support their long necks. Their thin legs grow super straight to keep them from bending outward at the knees under the weight of their bodies. Their blood pressure is twice as high as ours, allowing them to pump blood more than 6 feet up to their brains.

Scientists know that these adaptations all emerged relatively quickly on an evolutionary scale. This is because the giraffe and its closest relative, the okapi, only separated from a common ancestor around 11 million years ago. Since then, the giraffe has changed its appearance while the okapi has kept the zebra-like look of their ancestor.

But the giraffe's genes suggest that these changes were the result of a few subtle mutations, or changes. Genes are segments of DNA that tell a specific part of the body how to grow and function.

A genome is made up of DNA and genes and contains all of the hereditary information about a living thing's body and how it works. The first full genome sequences of the giraffe and the okapi were published Tuesday in Nature Communications.

Subtle DNA Changes Can Have Big Results

Douglas Cavener of Penn State University conducted the research with Morris Agaba of the Nelson Mandela African Institute for Science and Technology in Tanzania. Cavener said that he was pleasantly surprised by the findings. The men compared the genomes of different animals to figure out what genes might give giraffes their traits. They included the genomes of the giraffe and the okapi along with those of 40 other mammals, including humans, in their study. The okapi and giraffe genome are very similar. Therefore, any differences could be used to hunt down the genes behind long necks and hardy hearts.

Instead of completely new genes, they found 70 genes with mutations specific to giraffes.

There's a belief that to make something new in evolution, there has to be a drastic change at the DNA level, Cavener said. That belief is wrong, he said.

"You can have these very subtle changes in DNA that create dramatic effects," Cavener said.

That Long Neck Needs A Sturdy Heart

Most of the genes they found are known to help regulate physical development in other mammals, which is exciting. It supports the idea that tweaking these genes could turn a donkey-like creature into the tallest animal on land.

Some of the genes they found, such as FGFRL1, influence both the skeletal and cardiovascular development in other mammals.

This makes sense, because an animal with a very long neck could not survive without a strong cardiovascular system, Cavener said. Changes in the genes that affect both skeletal and cardiovascular systems could have created long necks and strong hearts to support them. A change on the skeletal gene alone might have resulted in one very dead giraffe.

More research is needed to know whether or not these genes are definitely the cause of giraffes' long necks.

Placing Giraffe Genes In Mice

"A lot of subtle changes went into giraffe evolution, and we're just scratching the surface of what the genetic changes are," Cavener said.

Cavener plans to test out some of these genes soon. He and his team will breed genetically modified mice, replacing some of their genes with the mutated giraffe genes. With any luck, they might see some familiar-looking skeletal or cardiovascular changes in the mice.

The researchers hope to discover how these creatures handle such high blood pressure without injury. Understanding how giraffes do this could help develop treatments for humans. In addition, the study of the giraffe genomes will have more immediate applications. The team plans to look at the genomes of possible subspecies of giraffe to determine whether they are actually distinct from one another.

Subspecies Could Be Endangered

If the subspecies are indeed distinct from one another, then some of them are clearly endangered, Cavener said. Populations have declined by 40 percent over the past 15 years because of poaching and loss of the places where giraffes naturally live, or habitats, he said. Some estimate that there could be fewer than 10,000 giraffes left by the end of the century. But if some giraffe populations have unique genes, they could disappear even sooner.

The genome sequences could be quite useful in finding those endangered subspecies, Cavener Said.

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