

Australian Lungfish Has Biggest Genome Ever Sequenced

The air-breathing fish dethrones the Mexican axolotl for the title of largest known genome in the animal kingdom



An Australian lungfish (*Neoceratodus forsteri*) at the Haus des Meeres in Vienna, Austria. (IMP / Schedl.)

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New research suggests the Australian lungfish has the largest genome of any animal ever sequenced, reports Donna Lu for *New Scientist*. The study also reveals lungfishes are most closely related fish to humans and other land-loving vertebrates.

As its name suggests, this strange fish lives in Australia and can breathe air when water is scarce or low in oxygen using a single, oblong lung, according to the [Australian Museum](#). This primitive looking fish, with its heavy plate-like scales and lobed fins, has a 43-billion-base-pair genome—roughly 14 times the number of base pairs in the human genome. The previous record holder, the Mexican [axolotl](#), has a genome made up of 32 billion base pairs. The researchers reported their findings last week in the journal *Nature*.

The lungfish's genome was so big that, even with the latest computers, sequencing it took an estimated 100,000 hours of processing power, Siegfried Schloissnig, a geneticist at the Research Institute of Molecular Pathology in Austria (IMP), tells *New Scientist*.

Studying the Australian lungfish's huge genome could help reveal the genetic roots of adaptations that eventually allowed fishy ancestors to crawl onto land for good some 400 million years ago. The sequenced genome reveals some surprising overlap between humans and this scaly, aquatic animal. For example, the same set of genes control the embryonic development of lungs and the sense of smell in the Australian lungfish and humans, despite the fact that our evolutionary paths diverged some 420 million years ago.

"The lungs of lungfish can therefore evolutionarily be traced to the same origin as those of terrestrial vertebrates, including humans," says Axel Meyer, an evolutionary biologist at the University of Konstanz and one of the study's co-authors, in a [statement](#).

This air breathing fish's front fins even have an ulna and a radius like our forearms do, and they're coded by the same set of genes, reports Tessa Koumoundouros for *Science Alert*.

"In order to get out of the water, you need to adapt towards a terrestrial lifestyle," Schloissnig tells *New Scientist*. "You have to be able to breathe air, you have to be able to smell. When you look at it from a genomic perspective, it is genomically halfway between a fish and a land-based vertebrate."

With these striking bits of genetic overlap, it might not be a surprise to know that the Australian lungfish is the closest living relative of the fish that first colonized the land, and then, over some 400 million years, gave rise to human beings. Previously, researchers pegged the similarly lobe-finned coelacanth as the living fossil that was most closely related to the pioneering fish that left the water, per *Science Alert*.

"There is no doubt that the newly sequenced genome will unveil more of the secrets of this bizarre vertebrate in the future," says Elly Tanaka, a molecular biologist at IMP and co-author of the research, in a [statement](#). "Not only can it teach us things about adaptations to life on land, but it may also explain how certain genomes evolve to be so big."

About Alex Fox



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