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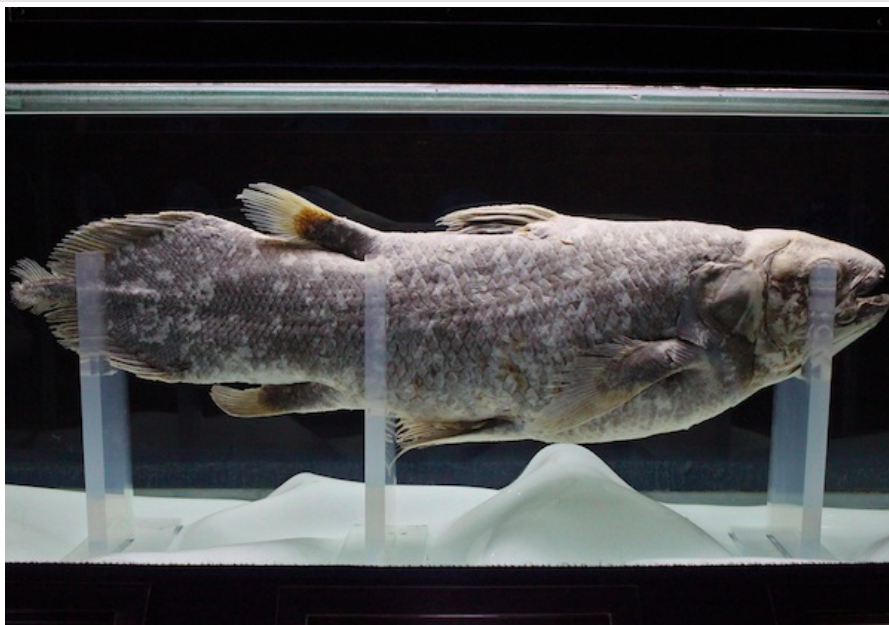
Surprising Science

April 17, 2013

[DNA Sequencing Reveals that Coelacanths Weren't the Missing Link Between Sea and Land](#)

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The rare coelacanth's genome is slowly evolving—and contrary to prior speculation, it probably isn't the common ancestor of all land animals. Image via [Wikimedia Commons/Amelia Guo](#)

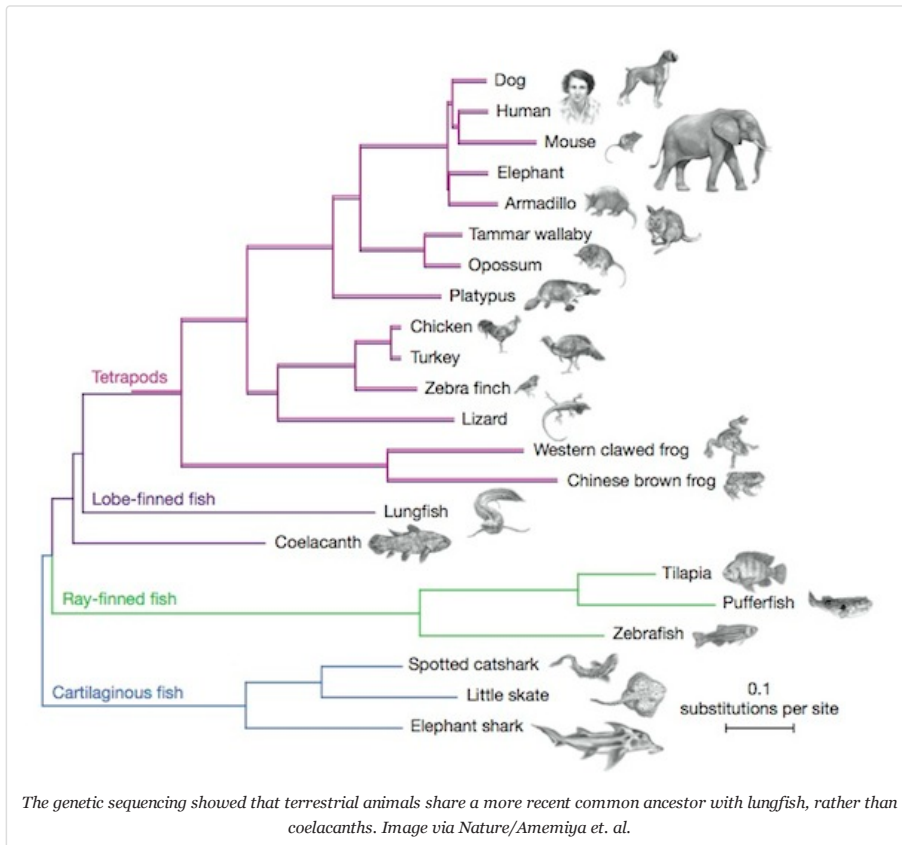
On December 23, 1938, South African Hendrick Goosen, the captain of the fishing trawler *Nerine*, found an unusual fish in his net after a day of fishing in the Indian Ocean off of [East London](#). He showed the creature to local museum curator [Marjorie Courtenay-Latimer](#), who rinsed off a layer of slime and [described it as](#) “the most beautiful fish I had ever seen...five foot long, a pale mauvy blue with faint flecks of whitish spots; it had an iridescent silver-blue-green sheen all over. It was covered in hard scales, and it had four limb-like fins and a strange puppy dog tail.”

The duo, it turned out, had made one of the most significant biological discoveries of the 20th century. The fish was a [coelacanth](#), a creature previously known only from [fossilized specimens](#) and believed to have gone extinct about 80 million years earlier. Moreover, its prehistoric appearance and unusual leg-like lobed fins immediately suggested to biologists that it could be an ancient ancestor of all land animals—one of the pivotal sea creatures that first crawled onto solid ground and eventually evolved into amphibians, reptiles, birds and mammals.

Now, though, the coelacanth's full genome has been sequenced for the first time, and the results, [published by an international team of researchers today in *Nature*](#), suggest otherwise. Genetic analysis suggests that the coelacanth doesn't appear to be the most recent shared ancestor between sea and land animals—so its lobed fins didn't make that first fateful step onto land after all.

When the researchers used what they found out about the coelacanth's genome to build an evolutionary tree of marine and terrestrial animals (below), they found it's more likely that ancestors of closely-related class

of fish called **lungfish** played this crucial role. The ancestors of coelacanths and lungfish split off from each other before the latter group first colonized any land areas.



Additionally, the coelacanth’s prehistoric appearance has led to it commonly being considered a “living fossil”: a rare, unchanging biological time capsule of a bygone prehistoric era. But the genomic sequencing indicated that the fish species is actually still evolving—just very, very slowly—supporting the recent argument that **it’s time to stop calling the fish and other seemingly prehistoric creatures “living fossils.”**

“We found that the genes overall are evolving significantly slower than in every other fish and land vertebrate that we looked at,” Jessica Alföldi, a scientist at MIT and Harvard’s [Broad Institute](#) and a co-author, said in a [press statement](#). Small segments of the fish’s DNA had previously been sequenced, but now, she said, “This is the first time that we’ve had a big enough gene set to really see that.”

The fact that the fish is evolving isn’t surprising—like all organisms, it lives in a changing world, with continuously fluctuating selection pressures that drive evolution. What’s surprising (though reflected by its seemingly-prehistoric appearance) is that it’s evolving so slowly, compared to a random sampling of other animals. According to the scientists’ analysis of 251 genes in the fish’s genome, it evolved with an average rate of 0.89 base-pair substitutions for any given site, compared to 1.09 for a chicken and 1.21 for a variety of mammals (base-pair substitution refers to the frequency with which **DNA base-pairs**—the building blocks of genes—are altered over time).

The research team speculates that the coelacanth’s extremely stable **deep Indian Ocean environment** and relative lack of predators might explain why it has undergone such slow evolutionary changes. Without new evolutionary pressures that might result from either of these factors, the coelacanth’s genome and outward appearance have only changed slightly in the roughly **400 million years** since it first appeared on the planet.

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