ONE THAT GOT AWAY

You had to crawl before you could walk. But for paleontologists it's even more important that you had to swim before you could crawl. Before four-legged vertebrates crawled up on land 370 million years ago and started breathing air, they were splashing around in the water. The last real fish on the road to this transition, according to some researchers, was probably something like today's lungfish, a peculiar creature equipped with primitive lungs that allow it to breathe air. If some ancestral lungfish gave rise to both today's version and the first vertebrates to make land—amphibians like frogs—that makes the lungfish our closest living relative without legs.

In May a trio of German researchers challenged this notion. Citing some striking similarities in blood proteins, Thomas Gorr of the Max Planck Institute for Biochemistry in Munich and his colleagues declared that the nearest fish to a frog—and thus to us—is the coelacanth. That's a primitive-looking fish so rare that scientists thought the last one died about 50 million years ago—until a live specimen turned up in the Indian Ocean in 1938.

But the claim, published in the journal *Nature,* has triggered a bitter backlash from other researchers, who say that Gorr's work is little more than a fish story. "My impression is that Gorr didn't know how to analyze his data," says biochemist Axel Meyer of the State University of New York at Stony Brook. "I'm surprised it was published."

The work is based on the assumption that proteins in closely related descendants of a common ancestor look more like one another than like the proteins of a more distant relative. So Gorr and his colleagues examined the sequence of amino acids that make up hemoglobin, the protein that carries oxygen through the bloodstream. They compared the hemoglobin in frog tadpoles to the hemoglobin in a lungfish, a coelacanth, and several other fishes. The tadpole and the coelacanth hemoglobin made the closest match.

"If Gorr is right, it means we can look at coelacanth biology and behavior and deduce what our ancestors were doing 370 million years ago, when amphibians and fish split off," says Peter Forey, a paleontologist at the Natural History Museum in London.

But that's a big if. Forey believes that anatomy still favors the lungfish. The closest feature a coelacanth has to lungs is an oil-filled bladder it uses for buoyancy. This bladder seems a less likely candidate to evolve into working lungs than what the lungfish already has.

And this objection is mild when compared with other complaints. "Frankly, it was a little shocking to me when I saw the paper," says biologist David Swofford of the Illinois Natural History Survey. "The results simply don't reflect logical reasoning." Swofford points out that Gorr's group focused on protein sequences if they were shared by only two species; if that sequence also showed up in a third species, Gorr's team left it out of their calculations altogether. It's as if the researchers looked at five kids, three with blond hair and two with snub noses, and decided that the kids with snub noses were the only ones with any similar features. If all the protein similarities are included, Swofford says, coelacanths share no more features with frogs than do any other fish.

"We had three referees for our paper, and they never doubted our methods," retorts biochemist Traute Kleinschmidt, a member of Gorr's team. "They didn't like our results because they were fond of the lungfish theory, but they didn't say that our methods were wrong."

Yet the complaints keep coming, some from beyond the grave. Noted biochemist Allan Wilson, who died of leukemia this summer, had a posthumous letter published in *Nature,* with Meyer as coauthor. They did their own comparison of fish and frogs, but instead of hemoglobin they compared sequences of the master molecule that codes for it: DNA. These sequences contain three times as many points of comparison as do proteins, Wilson and Meyer reasoned, so they give a clearer picture of evolution. And that picture is of a family tree with lungfish on the branch closest to frogs.

"This was Wilson's last paper," says Meyer. "We worked on it through his bone marrow transplant, sending faxes back and forth from the hospital. His widow told me later that he was more interested in working on the paper than in reading the sympathetic notes he got. He wanted to set the record straight."

–Joshua Fischman

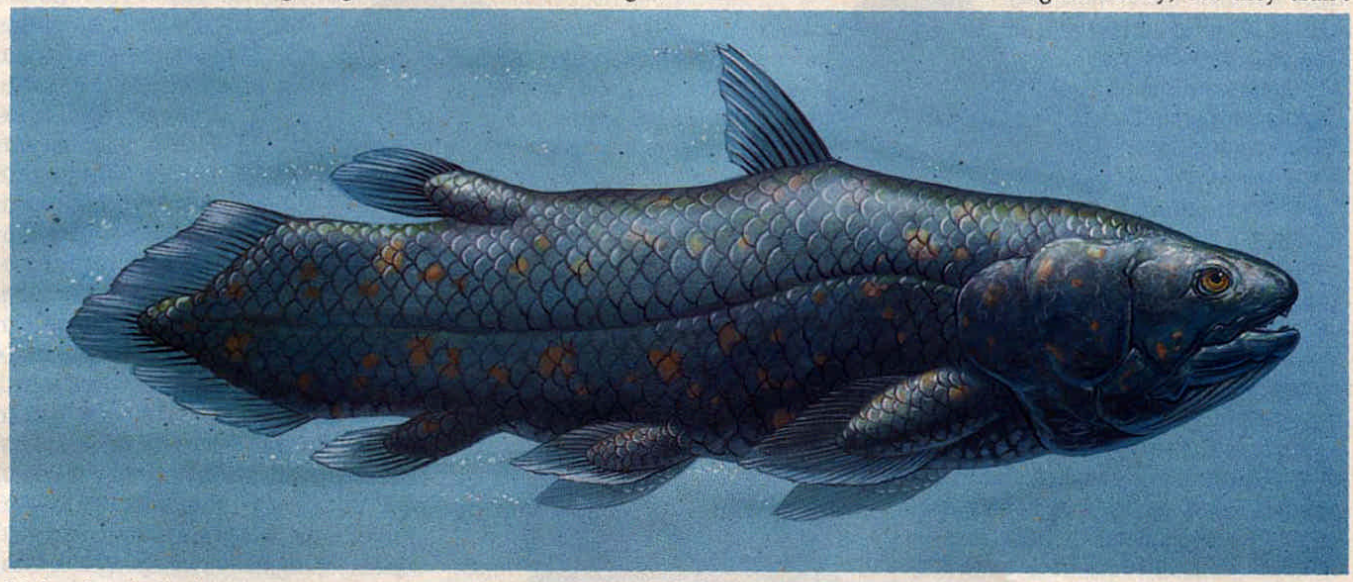

ILLUSTRATION BY WALTER STUART

Molecular similarities indicate the coelacanth is our closest fish relative. But some scientists say the research is all wet.