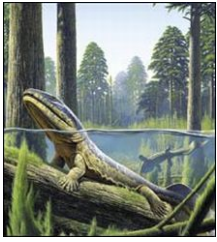


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[How did fish grow legs?](#)

A new perspective on how tetrapods evolved from fish

The fossils found in the last 15 years allow a much more detailed perspective on how did our first ancestors that ventured out of the water evolve. Once all the discovered pieces of the puzzle are fit together, a synthesis carried out by Jennifer A. Clack in her Scientific American paper 'Getting a Leg Up on Land', a new image is developed. This image is considerably different from the one biologists held until recently. Going back 15 years ago, only two relevant fossils were discovered: one of a fish and one of a tetrapod. But the answer to the question "how did the fish evolve into the tetrapod?" was left to pure speculation. The most popular such speculation was done in the '50s by the Harvard paleontologist Alfred Sherwood Romer and maintained that during a drought fish living in small water puddles were forced to go from one puddle to another. In order to do such a thing they had to pass certain short distances on dry land. Gradually, these distances grew, and legs were an adaptation that helped the fish going from one puddle to another. In other words, the theory said that the fish got out of the water and only afterwards it developed legs and eventually the capacity to breath out of the water. The discovered fossils offer a relatively detailed picture of a 20 million years period during which terrestrial tetrapods evolved from fish. However, this picture does not support Romer's theory. First of all, it seems that fish grew legs long before they got out of the water. A first clue in this direction was offered by the fossil of an animal which although having legs most certainly couldn't use them to support its weight on the ground or to walk with them (in the image below you can see the transition - the lowest animal is the most primitive). In other words, if those legs were of any use at all, they certainly weren't useful for walking. But what were they useful for? The answer to this question came from a somewhat neglected direction: the issue of fingers. When they first appeared, what were fingers used for, what kind of advantage did a fish with legs and fingers have over its colleagues? The researchers have discovered that initially the aquatic tetrapods had eight fingers and not five, as all of us "modern" tetrapods. The transition from eight to five fingers is clearly supported by fossil evidences. This transition was probably determined precisely by the transition in the role of legs: when legs began to be used for walking the coordination of eight fingers was difficult and energy consuming; thus our ancestors gradually lost some fingers until only five of them remained. When the tetrapods were still aquatic, the legs and fingers played a different role, a much more passive role. An entirely surprising role: they were helping the fish to keep its head out of the water in order to breathe the air! That is the fish not only developed their legs while still being in water but they also developed the capacity of breathing air while still in water. This seems incredible: as Clack wrote, "why, after millions of years of successfully breathing underwater, did some fish begin turning to the air for their oxygen?" One clue comes from the climatologists. Dating the fossils we can tell when those animals have lived, and the climatologists can tell us how the climate was back then. During the time when these fish "decided" to grow their legs and started breathing air, during the Devonian, the climate was very hot. It is also known that, and this is no accident, is the same period plants had a spectacular growth both on land and in water. We can imagine how the environment of those fishes has changed: the plants grew and became luxuriant; while the small fish liked this, the big ones were not enjoying it at all. Moreover, and maybe most importantly, warm water retains less oxygen than cool water and thus the big fish have found themselves suffocating in the new environment. They didn't have much choice: they either died out or learned how to breathe air. Thus, it isn't an accident that all the first terrestrial tetrapods were carnivorous - this was deduced from the shape of their jaws. What one gets is a fascinating

evolutionary image, completely different from the previous one. Until recently the primitive tetrapods were considered some un-adapted animals that weren't fit either for land or water. Now it is clear that they were adapted to the aquatic life of their own time. Meanwhile the times have changed, but they have reached land and their adaptations for the aquatic life during the Devonian have found new uses for the life on land. All these fossil evidences have now been interpreted and synthesized into a new image that has helped scientists unravel the details of the transition from fish to four-legged animals. Furthermore, they allowed establishing more precisely the moment when tetrapods had appeared: around 380-375 millions years ago, in the late Middle Devonian. **Update:** [The Missing Link Between Fish and Four-Legged Land Animals Was Found](#)