

DIGS

RETRACING THE FOOTSTEPS OF EVOLUTION: A rare missing link turns up in a museum drawer

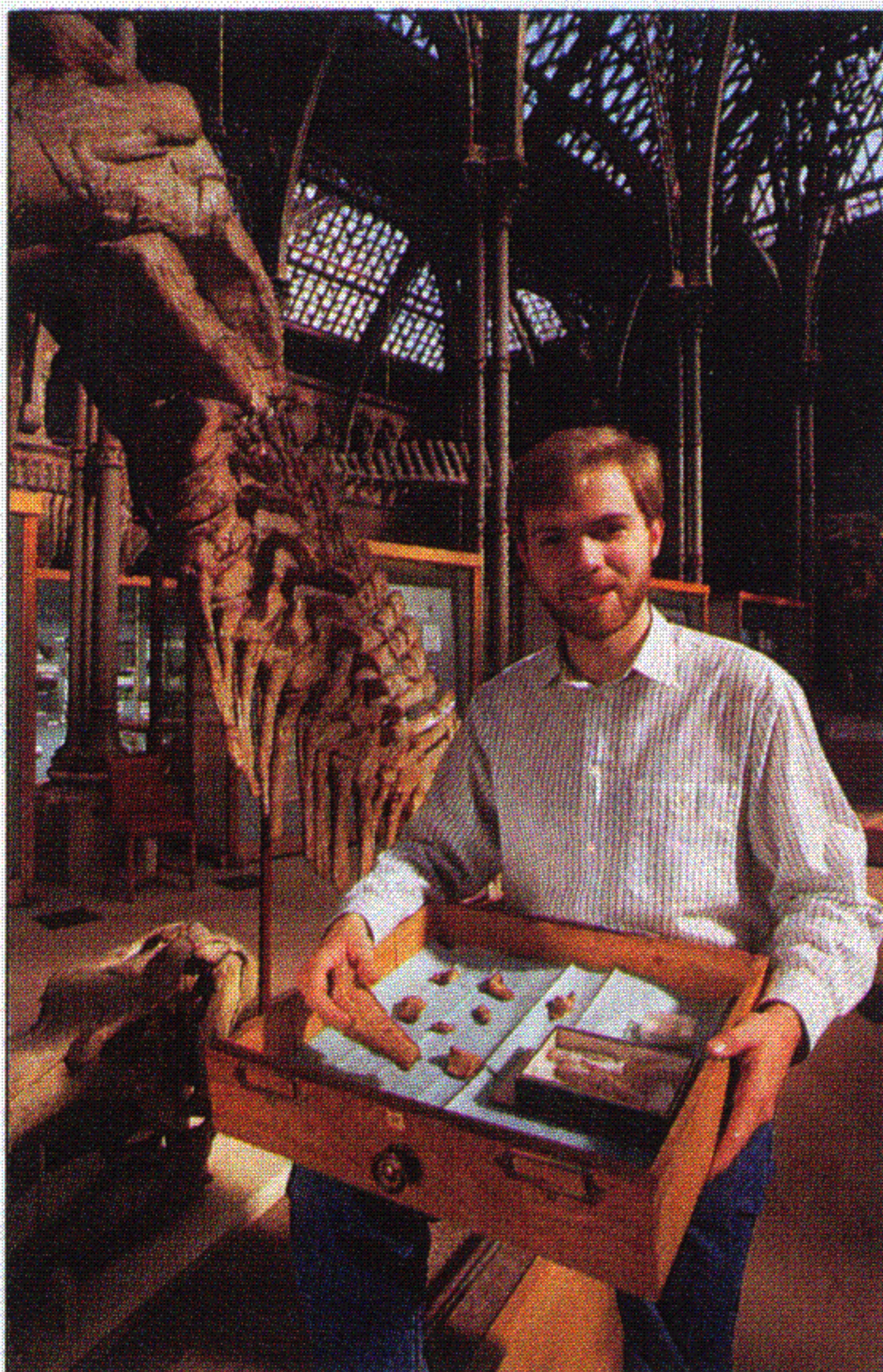
By Kathleen McAuliffe

Discovery in a drawer: The mislabeled bones that Per E. Ahlberg (right), an Oxford University paleontologist, found in a museum drawer raise some fascinating questions about the course of evolution.

Most fossil hunters chip away at rock or dig deep trenches in the ground. Oxford University paleontologist Per E. Ahlberg made a stunning discovery a less arduous way: He launched a dig through museum drawers, emerging from the unorthodox excavation with previously overlooked bones that represent a rare missing link in the transition of life from water to land.

The bones had gathered dust at the university's museum since about 1860, twenty years after the original collector retrieved them from a fossil-rich cliff in Scotland known as Scat Craig. The label on the drawers told generations of scholars that the skeletal parts belonged to ancient lobe-finned fish. But Ahlberg's well-trained eyes spotted something else. One of the jaw bones, he noticed, bore the distinct hallmarks of an early tetrapod—a four-legged creature that developed sometime after lobe-finned fish and before the first fully terrestrial vertebrates. His hunch was later confirmed when he pulled a tell-tale tibia—a shin bone—from the collection. Since all the bones in those drawers had come from deposits laid down during the upper-Devonian period—some 367 million years ago—the fragments were probably almost 10 million years older than any known tetrapod, substantially pushing back the date when life in the water began its progression toward the shores.

It's still not clear whether the tetrapod parts recovered from the Scat Craig collection all came from the same animal. Regardless, the bones speak volumes about a critical juncture in natural history. The sheer size of the skeletal parts presented the first major surprise. Scholars had long assumed that early tetra-



pods had to be small, lightweight creatures to counter the crushing force of gravity on land. But Ahlberg's discovery tells a different story. The skull he turned up stretches nearly a foot and a half long, and he estimates the full body length of these animals to be about five feet.

Assuming all of the limb bones belonged to the same animal, Ahlberg's tetrapod had well-developed hind limbs and front limbs more like the fins of a fish. This chimera of traits suggests to Ahlberg that water-dwelling organisms must have originally developed legs for some purpose other than walking on land. His theory flies in the face of conventional doctrine, which maintains that vertebrate limbs first evolved to carry fish to a new source of water when their shallow pools began to dry up during the upper-Devonian period.

In fact, on climatic grounds alone, that hallowed notion now seems suspect. "It turns out that the Devonian period had monsoon weather not unlike parts of the Amazon," reports Jennifer

Clack, an authority on tetrapods at Cambridge University. "In all likelihood, fish didn't get stranded in shallow pools but simply retreated with the water line during dry spells."

So why did legs evolve? Both Ahlberg and Clack believe the hind limbs were designed to support the animals in shallow water. "The first tetrapods probably hung out in reed-choked riverbeds and used their legs to grasp onto weeds on the surface," Clack explains. "Suspended from their perches, they would be less inclined to create vibrations in the water that might alert prey." She points out that the Sargasso frog fish uses finger-like projections on its back fins for exactly that function today. In the view of the British researchers, tetrapods probably adjusted to a marginal existence on the fringes of swamps for at least 20 million years before embarking on the next major evolutionary step: crawling ashore with a fully developed four-legged gait.

These later tetrapods, of course, needed to breathe on land, but the researchers think they arrived well equipped. "Lobe-finned fish had primitive lungs for gulping air in oxygen-poor water," Ahlberg reports, "so by the time tetrapods appeared millions of years later, lungs were presumably standard equipment."

Ahlberg now wants to determine the true relationship between his tetrapod parts. To figure out which jaw and limbs go together, he needs to see how the bones came to rest in the ground. His most recent excavation at Scat Craig, however, bore no fruit: He and some colleagues from the Royal Museum of Scotland dug around in a likely fossil site—now a woman's garden—and turned up plenty of fish bits but no new tetrapods. **DO**