reactions, precipitation assays or parallel drug or toxin screening.

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Palaeontology

A polydactylous amniote from the Triassic period

The earliest four-limbed vertebrates, or tetrapods, lived between 370 million and 354 million years ago, during the Late Devonian period, and typically had more than five digits (polydactyly)[1]. We have discovered that a preaxial form of polydactyly, in which extra digits are positioned anterior to the first digit, has unexpectedly re-emerged in a marine reptile from the Early Triassic period about 242 million years ago — the overall morphology of both the manus and pes closely resemble those of the earliest tetrapods. Until now, no post-Devonian tetrapod has been found with a comparative type of polydactyly, so the new amniote provides a striking example of convergent evolution.

The new amniote is a marine reptile from Hubei Province in China (amniotes include reptiles, birds and mammals). Its most remarkable feature is the number of its digits: the forelimbs bear seven and the hindlimbs have six (Fig. 1). The extra digits on both fore- and hindlimbs are well developed and the bones are arranged normally as distal carpal/tarsal (distal carpals 3 and 4 are fused as a single large carpal in the forelimb of the new amniote), metacarpal/metatarsal and phalanges (see supplementary information).

Ichthyosaurs of the Mesozoic era (250–65 million years ago) had porpoise-like bodies, with dorsal and tail fins and often polydactylous limbs. This polydactyly, however, was quite different from that of the Devonian tetrapods. Modern pandas and moles[2], humans[2,3] and cats[4] occasionally have extra preaxial digits, but these are rarely morphologically or structurally comparable with a normal digit[2,3,5].

Almost all polydactyly in tetrapods can be referred to one of three types. In postaxial polydactyly, the extra digits are posterior to digit V, as seen in the Late Devonian *Tulerpeton*[6], some frog individuals and even humans[2,3]. In preaxial polydactyly, the extra digits are anterior to digit I, as seen in the fore- and hindlimbs of the new amniote, and in the hindlimbs of the Late Devonian *Ichthyostega* and forelimbs of the Late Devonian *Acanthostega*[1]. In bilateral polydactyly, the extra digits are anterior to digit I and posterior to digit V, as seen in the forelimbs of the ophthalmosaurian ichthyosaurs[7] and today in some polydactylous Indian families[3]; the extra digits on the hindlimbs of the Devonian *Acanthostega*[8] also appear to be of this type.

Other types of polydactyly can occur, for example in the forelimbs of many non-ophthalmosaurian ichthyosaurs[7]. Most occur by interdigital or postaxial phalangeal bifurcation[7]. Of the known polydactylous tetrapods, the new amniote is the only one that has both fore- and hindlimbs that are preaxially polydactylous, matching the current limb-development model[9] (see supplementary information).

The new amniote was a secondarily aquatic reptile and its polydactylous limbs are derived from adaptation to its aquatic life. Its manus and pes are short and wide, and generally resemble those of the Late Devonian *Ichthyostega* and *Acanthostega*. They are also comparable in shape to the limb-like paired fins of extant frogfishes[8,10]. The limbs of this amniote may have functioned in a similar way to those of the Devonian tetrapods or to the paired fins of frogfishes when moving across underwater substrates. In its morphology and way of life, the new amniote provides a good example of evolutionary convergence with the earliest tetrapods, as well as an analogy with frogfishes in vertebrate evolution.

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Figure 1 The Triassic polydactylous amniote, housed at the Shanghai Science and Technology Museum (specimen SSTM 5025). It is represented by the part and counterpart of an almost complete skeleton from which the anterior end of the snout and the tail tip are missing. The specimen was collected from the marine Jialingjiang Formation (late Early Triassic[11]) near Xunjiansi, Nanzhang County, Hubei Province, China. Taxonomically, SSTM 5025 is referred to Nanchangosauridae, Wang, 1959 of Hupehsuchia Young & Dong, 1972 in Diapsida Gauthier *et al.*, 1988 of Reptilia Gauthier *et al.*, 1988. Further details are available from X.-C. W. Scale bar, 10 cm.

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