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# Evolutionary history of the extant amphioxus lineage with shallow-branching diversification

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## Abstract

© 2017 The Author(s). Amphioxus or lancelets have been regarded as a key animal in understanding the origin of vertebrates. However, the evolutionary history within this lineage remains unexplored. As the amphioxus lineage has likely been separated from other chordates for a very long time and displays a marked left-right asymmetry, its evolutionary history is potentially helpful in better understanding chordate and vertebrate origins. We studied the phylogenetic relationships within the extant amphioxus lineage based on mitochondrial genomes incorporating new *Asymmetron* and *Epigonichthys* populations, and based on previously reported nuclear transcriptomes. The resulting tree patterns are consistent, showing the *Asymmetron* clade diverging first, followed by the *Epigonichthys* and *Branchiostoma* clades splitting. Divergence time estimates based on nuclear transcriptomes with vertebrate calibrations support a shallow diversification of the extant amphioxus lineage in the Tertiary. These estimates fit well with the closure of seaways between oceans by continental drift, ocean currents, and present geographical distributions, and suggest a long cryptic history from the origin of amphioxus to its most recent diversification. Deduced character polarities based on phylogenetic analyses suggest that the common ancestor of the extant amphioxus existed in a tiny epibenthic state with larva-like appearance of extant amphioxus, likely with ciliate epidermis.

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