

Development of oral and branchial muscles in lancelet larvae of *Branchiostoma japonicum*

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Abstract

The perforated pharynx has generally been regarded as a shared characteristic of chordates. However, there still remains phylogenetic ambiguity between the cilia-driven system in invertebrate chordates and the muscle-driven system in vertebrates. Giant larvae of the genus *Asymmetron* were reported to develop an orobranchial musculature similar to that of vertebrates more than 100 years ago. This discovery might represent an evolutionary link for the chordate branchial system, but few investigations of the lancelet orobranchial musculature have been completed since. We studied staged larvae of a Japanese population of *Branchiostoma japonicum* to characterize the developmental property of the orobranchial musculature. The larval mouth and the unpaired primary gills develop well-organized muscles. These muscles function only as obturators of the openings without antagonistic system. As the larval mouth enlarged posteriorly to the level of the ninth myomere, the oral musculature was fortified accordingly without segmental patterning. In contrast, the iterated branchial muscles coincided with the dorsal myomeric pattern before metamorphosis, but the pharynx was remodeled dynamically irrespective of the myomeric pattern during metamorphosis. The orobranchial musculature disappeared completely during metamorphosis, and adult muscles in the oral hood and velum, as well as on the pterygial coeloms developed independently. The lancelet orobranchial musculature is apparently a larval adaptation to prevent harmful intake. However, vestigial muscles appeared transiently with the secondary gill formation suggest a bilateral ancestral state of muscular gills, and a segmental pattern of developing branchial muscles without neural crest and placodal contributions is suggestive of a precursor of vertebrate branchiomic pattern. *J. Morphol.* 275:465-477, 2014. © 2013 Wiley Periodicals, Inc.

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Keywords

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