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www.elsevier.com/locate/developmentalbiology

PII: S0012-1606(17)30793-5
DOI: https://doi.org/10.1016/j.ydbio.2018.01.019
Reference: YDBIO7680

To appear in: *Developmental Biology*

Received date: 9 November 2017
Revised date: 27 January 2018
Accepted date: 28 January 2018

Cite this article as: Albert Y. Han, Sandeep Gupta and Bennett G. Novitch, Molecular specification of facial branchial motor neurons in vertebrates, *Developmental Biology,* https://doi.org/10.1016/j.ydbio.2018.01.019

Molecular specification of facial branchial motor neurons in vertebrates

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Abstract

Orofacial muscles are critical for life-sustaining behaviors, such as feeding and breathing. Centuries of work by neuroanatomists and surgeons resulted in the mapping of bulbar motor neurons in the brainstem and the course of the cranial nerves that carry their axons. Despite the sophisticated understanding of the anatomy of the region, the molecular mechanisms that dictate the development and maturation of facial motor neurons remain poorly understood. This fundamental problem has been recently revisited by physiologists with novel techniques of studying the rhythmic contraction of orofacial muscles in relationship to breathing. The molecular understanding of facial motor neuron development will not only lead to the comprehension of the neural basis of facial expression but may also unlock new avenues to generate stem cell-derived replacements. This review summarizes the current understanding of molecular programs involved in facial motor neuron generation, migration, and maturation, including neural circuit assembly.

Keywords: Embryologic patterning, motor neuron development, orofacial motor neurons

1. Introduction

Orofacial muscles of the head and neck region provide critical life sustaining behaviors that include feeding, breathing, and speaking. Due to the necessity of these behaviors for survival, the neural circuitry underlying these behaviors maintain strict conservation across terrestrial