The spinal cord shows the way – How axons navigate intermediate targets

Gemma de Ramon Francàs, Nikole R. Zuñiga, Esther T. Stoeckli

www.elsevier.com/locate/developmentalbiology

PII: S0012-1606(16)30466-3
DOI: http://dx.doi.org/10.1016/j.ydbio.2016.12.002
Reference: YDBIO7309

To appear in: *Developmental Biology*

Received date: 20 July 2016
Revised date: 26 November 2016
Accepted date: 1 December 2016

Cite this article as: Gemma de Ramon Francàs, Nikole R. Zuñiga and Esther T Stoeckli, The spinal cord shows the way – How axons navigate intermediat targets, *Developmental Biology,* http://dx.doi.org/10.1016/j.ydbio.2016.12.002

The spinal cord shows the way – How axons navigate intermediate targets

Gemma de Ramon Francàs[1], Nikole R. Zuñiga[1], Esther T. Stoeckli[*]

University of Zurich, Department of Molecular Life Sciences and Neuroscience Center Zurich, Winterthurerstrasse 190, 8057 Zurich, Switzerland

[*]Corresponding author: Esther Stoeckli. +41 44 635 4840 (phone). +41 44 635 6879 (fax). Esther.stoeckli@imls.uzh.ch

Abstract

Functional neural circuits depend on the establishment of specific connections between neurons and their target cells. To this end, many axons have to travel long distances to reach their target cells during development. Studies addressing the molecular mechanisms of axon guidance have to overcome the complexity of subpopulation-specific requirements with respect to pathways, guidance cues, and target recognition. Compared to the brain, the relatively simple structure of the spinal cord provides an advantage for experimental studies of axon guidance mechanisms. Therefore, the so far best understood model for axon guidance is the dI1 population of dorsal interneurons of the spinal cord. They extend their axons ventrally towards the floor plate. After midline crossing, they turn rostrally along the contralateral floor-plate border. Despite the fact that the trajectory of dI1 axons seems to be rather simple, the number of axon guidance molecules involved in the decisions taken by these axons is bewildering. Because guidance molecules and mechanisms are conserved throughout the developing nervous system, we can generalize what we have learned about the navigation of the floor plate as an intermediate target for commissural axons to the brain.

Keywords

axon guidance, commissural neurons, midline crossing, neural development

Introduction

The summary of what we have learned as a field using the dI1 axons as a model has been assembled into the current understanding of axon guidance mechanisms. Both the general mechanisms as well as the function of individual guidance molecules have been confirmed in other areas of the nervous system, both the central as well as the peripheral nervous system.

Axons navigate by integrating the signals derived from interactions between surface receptors on the axon tip, the growth cone, and guidance molecules in their environment (Kolodkin and Tessier-

[1] G. de Ramon and N. Zuñiga contributed equally to this work