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Research paper

Helios modulates the maturation of a CA1 neuronal subpopulation required for spatial memory formation

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ABSTRACT

Currently, molecular, electrophysiological and structural studies delineate several neural subtypes in the hippocampus. However, the precise developmental mechanisms that lead to this diversity are still unknown. Here we show that alterations in a concrete hippocampal neuronal subpopulation during development specifically affect hippocampal-dependent spatial memory. We observed that the genetic deletion of the transcription factor Helios in mice, which is specifically expressed in developing hippocampal calbindin-positive CA1 pyramidal neurons (CB-CA1-PNs), induces adult alterations affecting spatial memory. In the same mice, CA3-CA1 synaptic plasticity and spine density and morphology in adult CB-CA1-PNs were severely compromised. RNAseq experiments in developing hippocampus identified an aberrant increase on the Visinin-like protein 1 (VSNL1) expression in the hippocampi devoid of Helios. This aberrant increase on VSNL1 levels was localized in the CB-CA1-PNs. Normalization of VSNL1 levels in CB-CA1-PNs devoid of Helios rescued their spine loss *in vitro*. Our study identifies a novel and specific developmental molecular pathway involved in the maturation and function of a CA1 pyramidal neuronal subtype.

1. Introduction

Brain circuits show selective connectivities (Brown and Hestrin, 2009; Yoshimura and Callaway, 2005) that might structure information processing and its storage. In particular, the hippocampus is the main nucleus that controls episodic memory, while other nuclei such as the striatum are involved in procedural memory (Morris and Frey, 1997; Packard and Knowlton, 2002). The extent to which individual neurons are interconnected selectively within brain circuits is an unresolved problem in neuroscience. During the recent years, several laboratories

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