Couillard-Després *et al.: Intrinsic Activity*, 2019; **7**(Suppl.1):A3.8
doi:10.25006/IA.7.S1-A3.8
published online: 11 September 2019

INTRINSIC ACTIVITY

Joint Meeting of the Austrian Neuroscience Association (16th ANA Meeting) and the Austrian Pharmacological Society (25th Scientific Symposium of APHAR)

Innsbruck, 25–27 September 2019

MEETING ABSTRACT

A3.8

Functional integration of neuronal precursors in the adult murine piriform cortex

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Background: Immature neuronal populations can be found in the adult mammalian brain. In addition to the new neurons generated in the proliferative neurogenic niches, non-proliferative immature neurons can be detected in various structures, such as the piriform cortex. We recently demonstrated that non-proliferative immature neurons become in a stochastic manner structurally mature. The extent of functional maturation and integration of these non-proliferative neuronal precursors in the adult murine piriform cortex is largely unexplored. We thus questioned whether neuronal precursors eventually become equivalent to neighboring principal neurons upon integration or whether they represent a novel functional network element.

Methods: Adult brain neuronal precursors and immature neurons (complex cells) were labeled in transgenic mice (DCX-DsRed and DCX-CreERT2/flox-EGFP) and their electrophysiological properties were characterized with patch clamp experiments on acute brain slices. Additional reporter mice were perfused with 4% paraformaldehyde to allow for immunohistological and morphometric analyses of the newly mature neurons and their axon initial segments.

Results: Young complex cells in the piriform cortex of two- to four-months-old mice received only sparse synaptic input and fired action potentials at low maximal frequency, resembling neonatal principal neurons. Following maturation, the synaptic input detected on older complex cells was larger, but predominantly GABAergic, despite evidence of glutamatergic synaptic contacts. Furthermore, the rheobase current of old complex cells was larger and the maximal firing frequency was lower than those measured in neighboring age-matched principal neurons.

Discussion: The striking differences between principal neurons and complex cells suggest that the latter are a novel type of neuron and new coding element in the adult brain rather than simple addition or replacement for preexisting network components. In our upcoming research, exploring the network connectivity of complex cells and the neuromodulation controlling their rate of maturation will allow understanding their functional role for adult brain networks.

Acknowledgements: This work was funded by: Paracelsus Medical University PMU FFF: R-16/04/084-BEN, R-14/04/063-KÖN; Austrian Science Fund (FWF) F44010, F4413-B23 (SFB-F44 – "Cell Signaling in Chronic CNS Disorders"); German National Academic Foundation; Spanish Ministry of Economy and Competitiveness: SAF2015-68436-R, Generalitat Valencia Prometeo Excellence Program: PROMETEO 2013/069, and Fundación Alicia Koplowitz.

Keywords: piriform cortex – adult neurogenesis – complex cells – aging – patch clamp – neuronal plasticity

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