Title: Cellular diversity of the somatosensory cortical map plasticity

Authors: Koen Kole, Wim Scheenen, Paul Tiesinga, Tansu Celikel

PII: S0149-7634(17)30287-7
DOI: https://doi.org/10.1016/j.neubiorev.2017.11.015
Reference: NBR 3006

To appear in:

Received date: 12-4-2017
Revised date: 21-11-2017
Accepted date: 21-11-2017

Please cite this article as: Kole, Koen, Scheenen, Wim, Tiesinga, Paul, Celikel, Tansu, Cellular diversity of the somatosensory cortical map plasticity.Neuroscience and Biobehavioral Reviews https://doi.org/10.1016/j.neubiorev.2017.11.015

Cellular diversity of the somatosensory cortical map plasticity

Koen Kole[1,2], Wim Scheenen[1], Paul Tiesinga[2], Tansu Celikel[1]

(1) Department of Neurophysiology, (2) Department of Neuroinformatics, Donders Institute for Brain, Cognition, and Behaviour, Radboud University, Nijmegen - the Netherlands

Correspondence should be addressed to Koen Kole at k.kole@neurophysiology.nl

Keywords: Sensory deprivation, sensory enrichment, mRNA, protein, synaptoneurosome, experience dependent plasticity, barrel cortex, rodents, brain disorders, neurovascularization, cerebral vasculature

Highlights

- Experience alters gene transcription in all major cell types of the brain
- Gene expression profile during brain plasticity is cell-type specific
- Temporal profile of gene expression is dynamic, regulated by recent experience
- Neural activity-dependent gene regulation might cause neurovascular reorganization
- Genes that are regulated by experience are commonly dysregulated in brain disorders

Abstract

Sensory maps are representations of the sensory epithelia in the brain. Despite the intuitive explanatory power behind sensory maps as being neuronal precursors to sensory perception, and sensory cortical plasticity as a neural correlate of perceptual learning, molecular mechanisms that regulate map plasticity are not well understood. Here we perform a meta-analysis of transcriptional and translational changes during altered whisker use to nominate the major molecular correlates of experience-dependent map plasticity in the barrel cortex. We argue that brain plasticity is a systems level response, involving all cell classes, from neuron and glia to non-neuronal cells including endothelia. Using molecular pathway analysis, we further propose a gene regulatory network that could couple activity dependent changes in neurons to adaptive changes in neurovasculature, and finally we show that transcriptional regulations observed in major brain disorders target genes that are modulated by altered sensory experience. Thus, understanding the molecular mechanisms