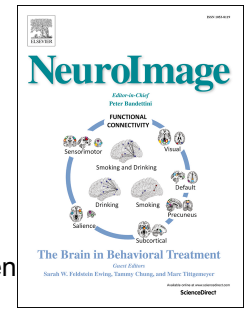
Accepted Manuscript



Contributions of dopaminergic and non-dopaminergic neurons to VTA-stimulation induced neurovascular responses in brain reward circuits

Marta Brocka, Cornelia Helbing, Daniel Vincenz, Thomas Scherf, Dirk Montag, Jürgen Goldschmidt, Frank Angenstein, Michael Lippert

PII: S1053-8119(18)30378-1

DOI: 10.1016/j.neuroimage.2018.04.059

Reference: YNIMG 14906

To appear in: *NeuroImage*

Received Date: 4 January 2018

Revised Date: 11 April 2018

Accepted Date: 25 April 2018

Please cite this article as: Brocka, M., Helbing, C., Vincenz, D., Scherf, T., Montag, D., Goldschmidt, Jü., Angenstein, F., Lippert, M., Contributions of dopaminergic and non-dopaminergic neurons to VTA-stimulation induced neurovascular responses in brain reward circuits, *NeuroImage* (2018), doi: 10.1016/j.neuroimage.2018.04.059.

Contributions of dopaminergic and non-dopaminergic neurons to VTA-stimulation induced neurovascular responses in brain reward circuits

Marta Brocka[1], Cornelia Helbing[2], Daniel Vincenz[1], Thomas Scherf[1], Dirk Montag[3], Jürgen Goldschmidt[1], Frank Angenstein[2, 4, 5 #eq], Michael Lippert[1#eq]

[1] Department Systems Physiology of Learning, Leibniz Institute for Neurobiology, Magdeburg, Germany
[2] Functional Neuroimaging Group, Deutsches Zentrum für Neurodegenerative Erkrankungen (DZNE), Magdeburg, Germany
[3] Neurogenetics, Leibniz Institute for Neurobiology, Magdeburg, Germany
[4] Center for Behavioral Brain Science (CBBS), Magdeburg, Germany
[5] Medical Faculty, Otto-von-Guericke University, Magdeburg, Germany

[#eq] These authors contributed equally

Corresponding author: Michael Lippert, Department of Systems Physiology, Leibniz Institute for Neurobiology, Brenneckestrasse 6, Magdeburg, Germany
Email: mlippert@lin-magdeburg.de

Keywords: optogenetics, BOLD, dopamine, ventral tegmental area, nucleus accumbens, rCBF

Abstract

Mapping the activity of the human mesolimbic dopamine system by BOLD-fMRI is a tempting approach to non-invasively study the action of the brain reward system during different experimental conditions. However, the contribution of dopamine release to the BOLD signal is disputed. To assign the actual contribution of dopaminergic and non-dopaminergic VTA neurons to the formation of BOLD responses in target regions of the mesolimbic system, we used two optogenetic approaches in rats. We either activated VTA dopaminergic neurons selectively, or dopaminergic and mainly glutamatergic projecting neurons together. We further used electrical stimulation to non-selectively activate neurons in the VTA. All three stimulation conditions effectively activated the mesolimbic dopaminergic system and triggered dopamine releases into the NAcc as measured by *in vivo* fast-scan cyclic voltammetry. Furthermore, both optogenetic stimulation paradigms led to indistinguishable self-stimulation behavior. In contrast to