Volume 106, Issue 2, Supplement 1, 383A, January 28, 2014

Open Archive

Distinct Target Selectivity of Fast-Spiking Interneurons in the Regulation of Striatal Output Pathways

Laurie S. Lambot · Serge N. Schiffmann · David Gall

Affiliations & Notes Article Info

The striatum is the main input nucleus of the basal ganglia. It receives excitatory inputs from the cortex and the thalamus that predominantly target the medium-sized spiny neurons (MSNs), the main neuronal cell-type and the projection neurons of the striatum. MSNs are divided in two subpopulations. A simplified model of the basal ganglia circuit proposes that the so-called "direct pathway" facilitates movements via the dMSNs, while the so-called "indirect pathway" terminates or suppresses movements via the iMSNs. Imbalances in the activity of both pathways are thought to have an effect on numerous movement disorders. Therefore, the output of the striatum is dependent upon which MSN type is stimulated, but also on their respective firing rate. These firing rates are themselves controlled by feedforward inhibition from local interneurons which is largely mediated by parvalbumin (PV)-expressing fast-spiking interneurons (FSIs). They inhibit to both direct and indirect pathway MSNs and are also interconnected with each other via electrical and chemical synapses. In order to understand how activity is regulated within the striatum, it is essential to understand the functional connectivity between the different neuronal types. Further, it is relevant to know whether feedforward inhibition differentially affect MSNs in the direct or indirect pathway. In this study we focus on the GABAergic microcircuits of the mouse striatum by investigating the target selectivity of striatal FSIs using optogenetic techniques, which enable us to selectively stimulate FSIs using pulses of 470 nm blue light. This approach is also combined with electrophysiological measurements using patch clamp recordings in acute brain slices. The inhibitory post-synaptic currents of both subpopulations of MSNs due to striatal microcircuitry FSI activation are compared in physiological and pathological models of chronic amphetamine/cocaine administration.