
Disynaptic inhibition promotes synchrony between striatal cholinergic interneurons and is regulated by dopamine via D2 receptors.

Gilad Silberberg*¹

¹Karolinska Institutet, Stockholm – Sweden

Abstract

Striatal activity is dynamically modulated by acetylcholine and dopamine, both of which are essential for proper basal ganglia function. Synchronized pauses in the activity of striatal cholinergic interneurons (ChINs) are correlated with elevated activity of midbrain dopaminergic neurons, whereas synchronous firing of ChINs induces local release of dopamine. The mechanisms underlying ChIN synchronization and its interplay with dopamine release are not fully understood. Here we show using multineuron patch-clamp recordings, voltammetry, optogenetics, chemogenetics, and in vivo recordings, that robust disynaptic inhibition between ChINs acts as an efficient synchronization mechanism. Inhibitory disynaptic responses were elicited by single action potentials in ChINs and showed a high degree of recurrence within the ChIN network. Disynaptic inhibition was attenuated by dopaminergic midbrain afferents acting on D2 receptors. Our results present a mechanism supporting synchronization of activity and pauses across the ChIN population and a novel form of interaction between striatal acetylcholine and dopamine.

*Speaker