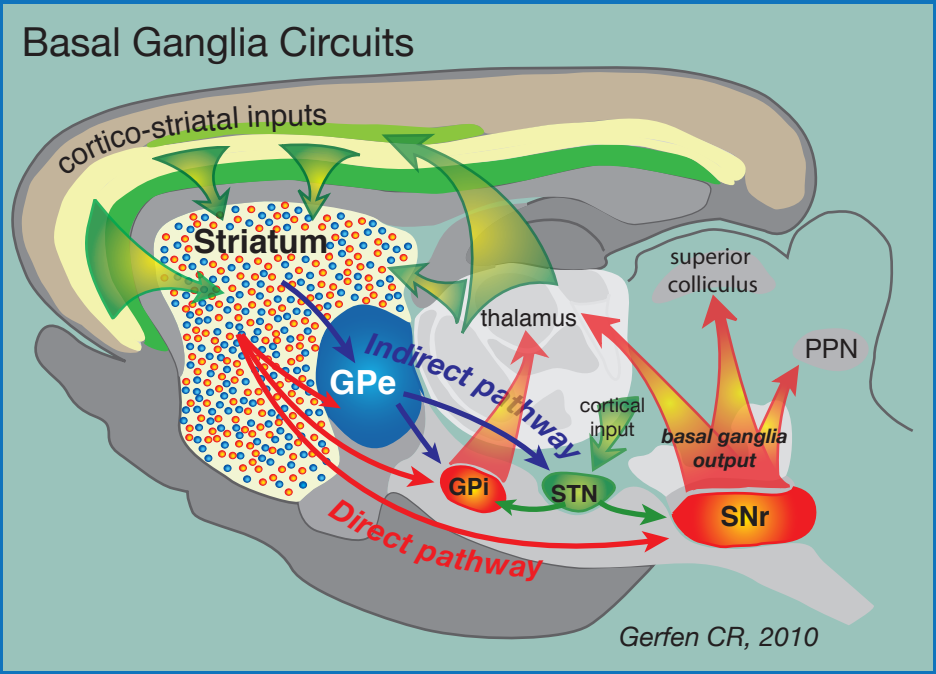
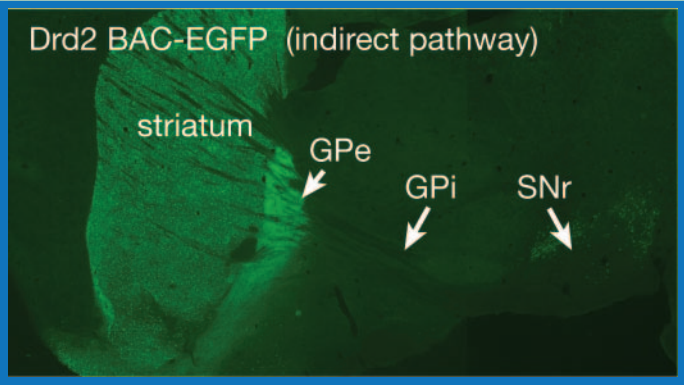
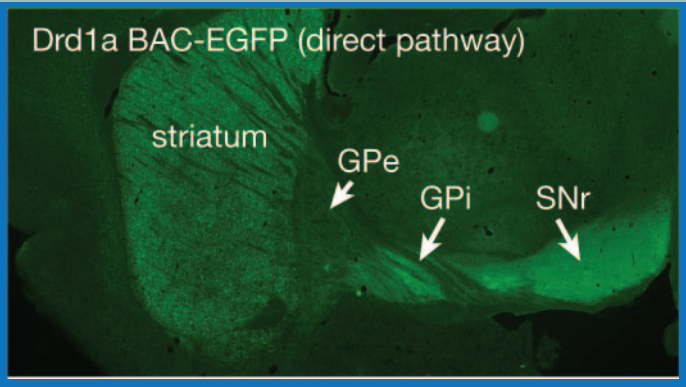


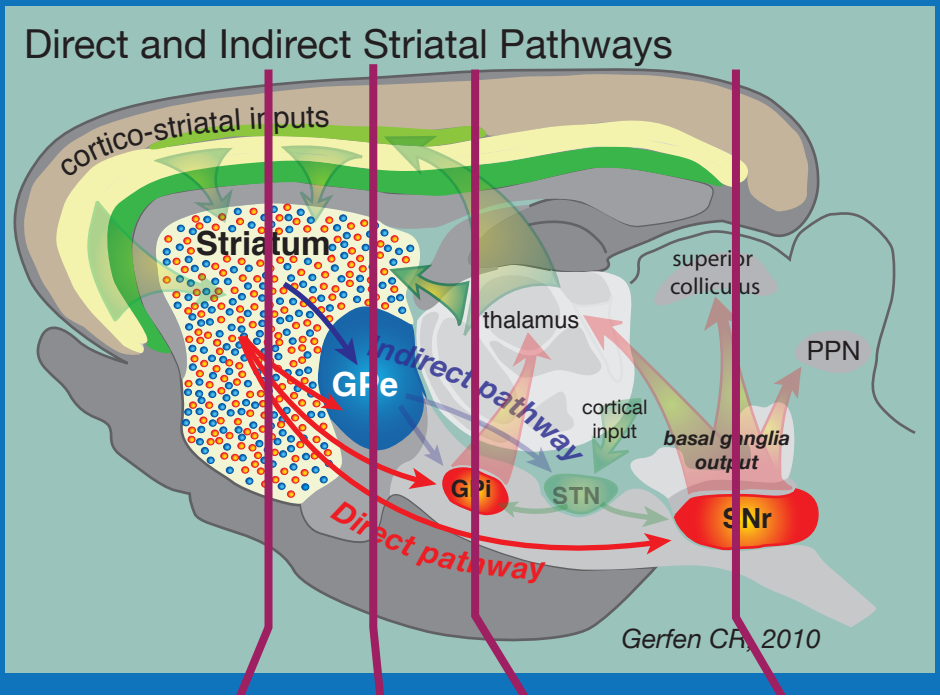
Diagram of basal ganglia circuits. The striatum receives excitatory corticostriatal and thalamic inputs. Outputs of the basal ganglia arise from the internal segment of the globus pallidus (GPi) and substantia nigra pars reticulata (SNr), which are directed to the thalamus, superior colliculus and pendunculopontine nucleus (PPN). The direct pathway originates from Drd1a expressing SPNs that project to the GPi and SNr output nuclei. The indirect pathway originates from Drd2 expressing SPNs that project only to the external segment of the globus pallidus (GPe), which together with the subthalamic nucleus (STN) contains transynaptic circuits connecting to the basal output nuclei. The direct and indirect pathways provide opponent regulation of the basal ganglia output interface.



Fluorescent of imaging of a brain section from a Drd2-EGFP mouse shows labeled striatal neurons that provide projections that terminate in the GPe, but do not extend to the GPi or SNr.

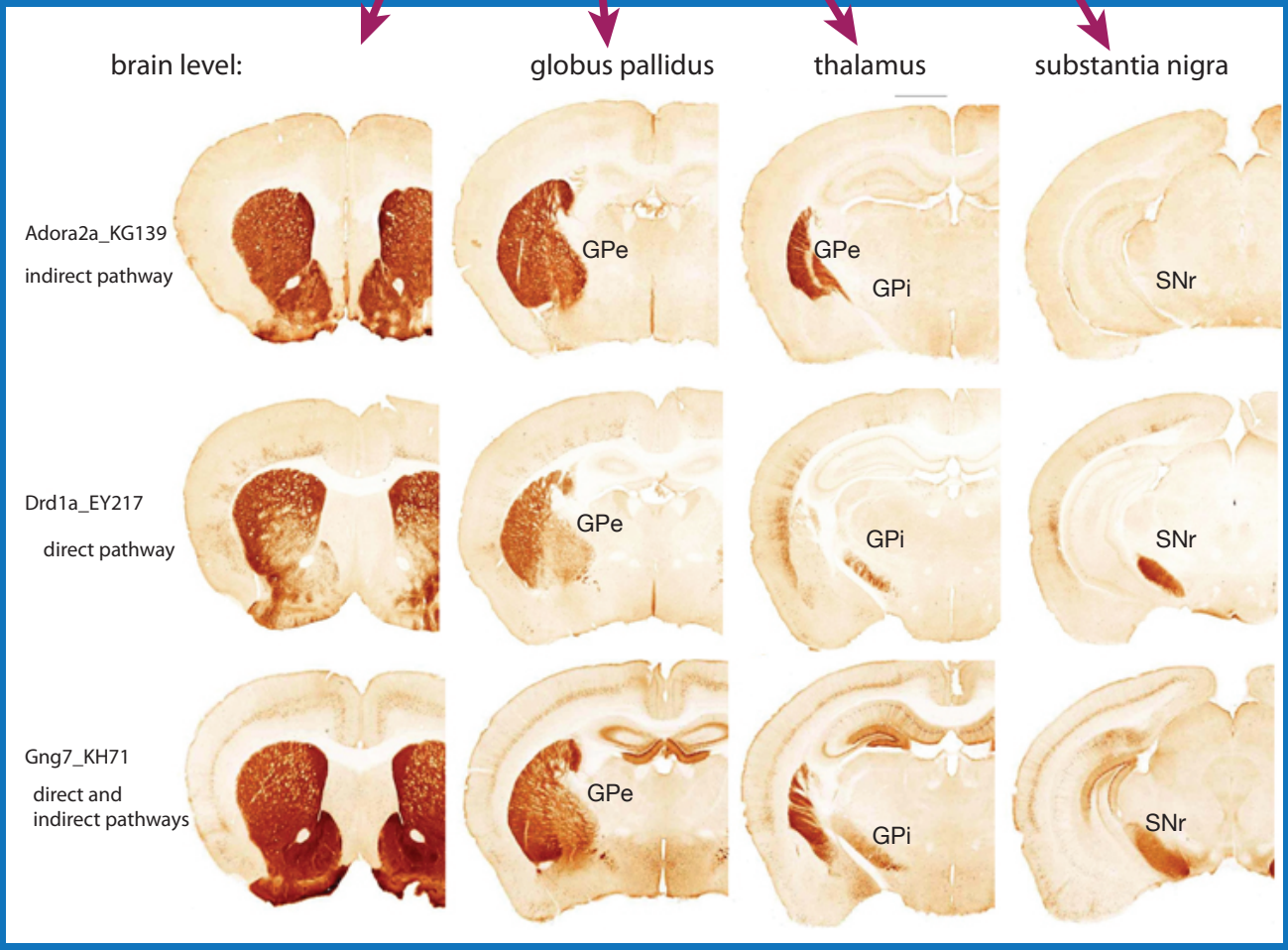


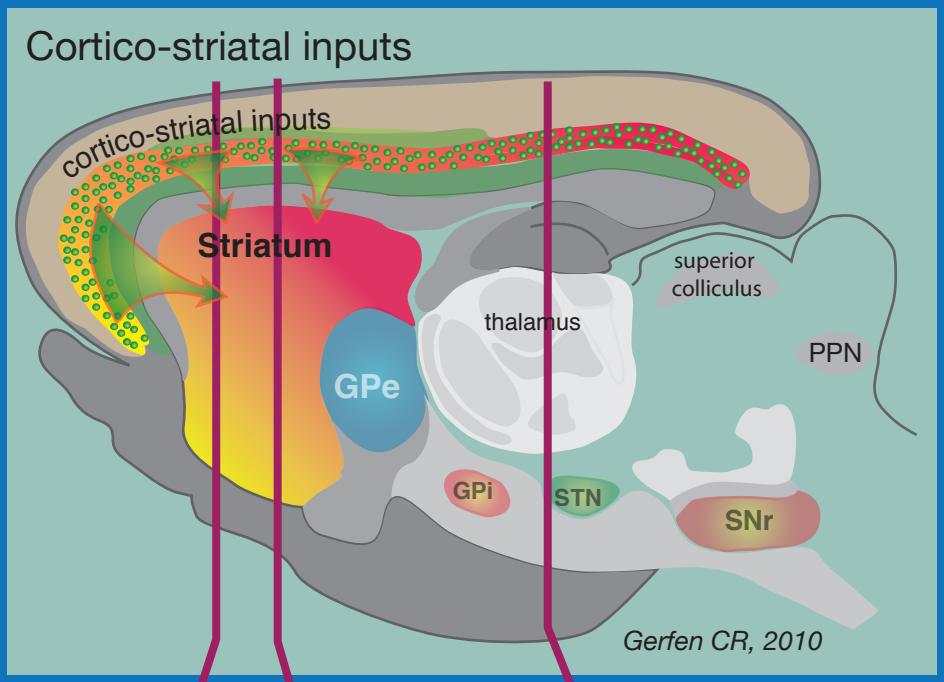
Fluorescent imaging of a brain section from a Drd1a-EGFP mouse shows labeled striatal neurons that extend axons through the GPe, which go on to terminate in the GPi and GPe.



BAC-Cre driver lines from Basal Ganglia Circuit collection that label direct/indirect pathways

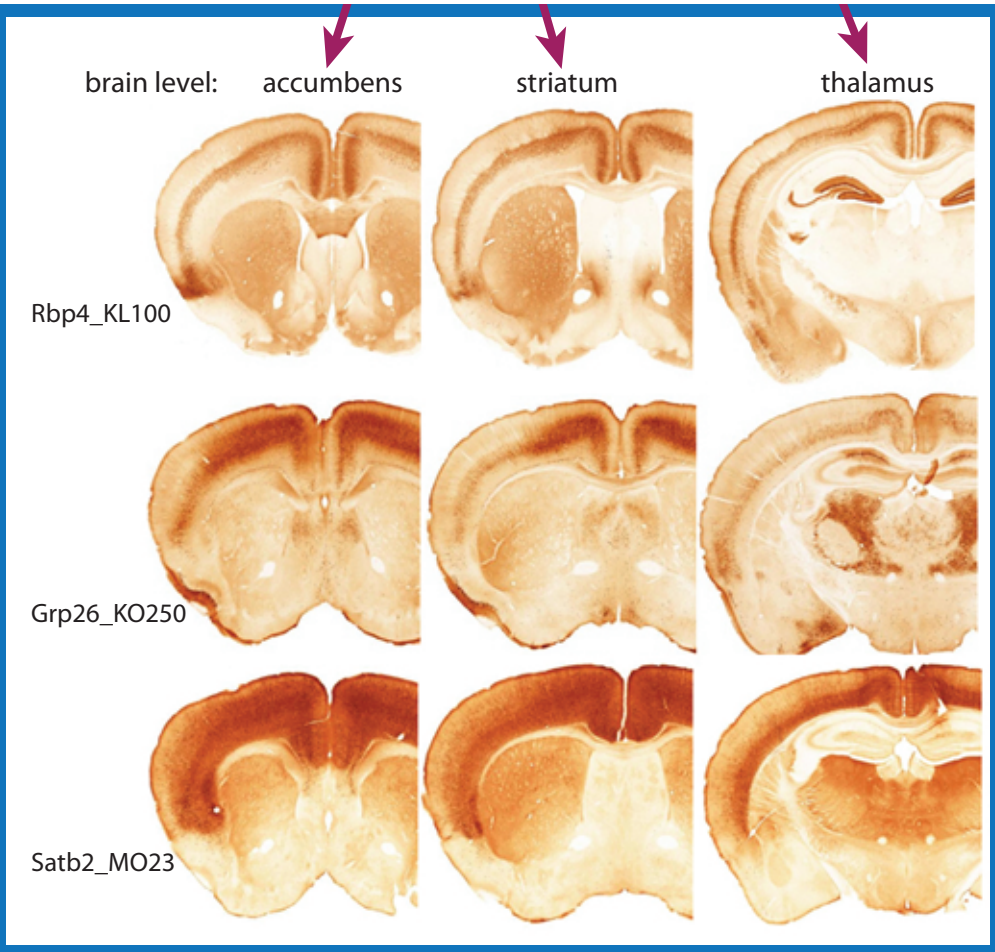
Adora2a_KG139: indirect striatal pathway neurons, which project only to GPe
Drd1a_EY217: direct striatal pathway neurons, which project mainly to GPi and SNr
Gng7_KH71: both direct and indirect striatal pathway neurons with projections to GPe, GPi and SNr

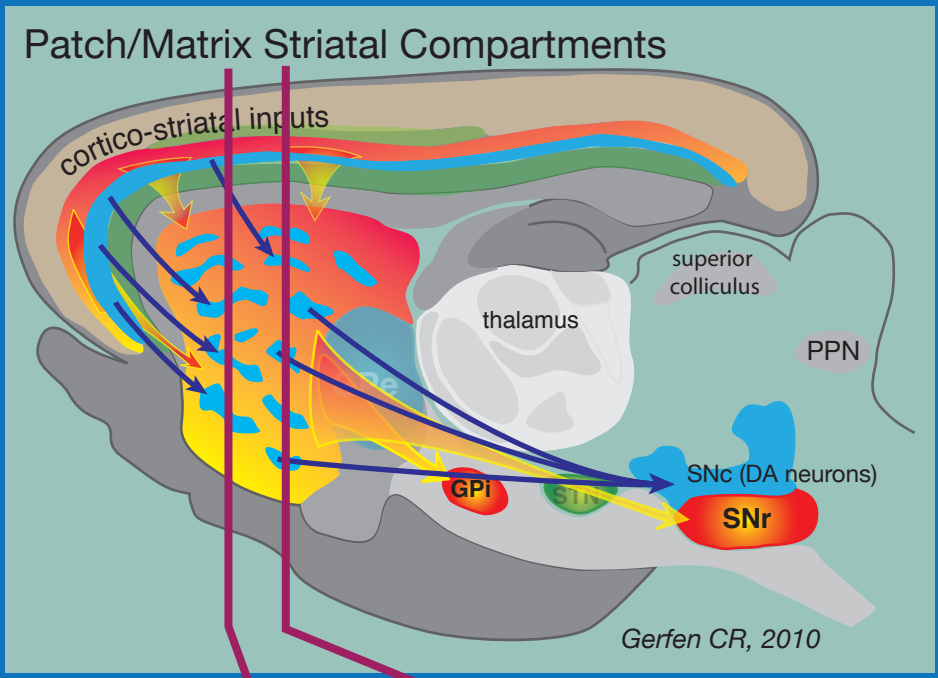


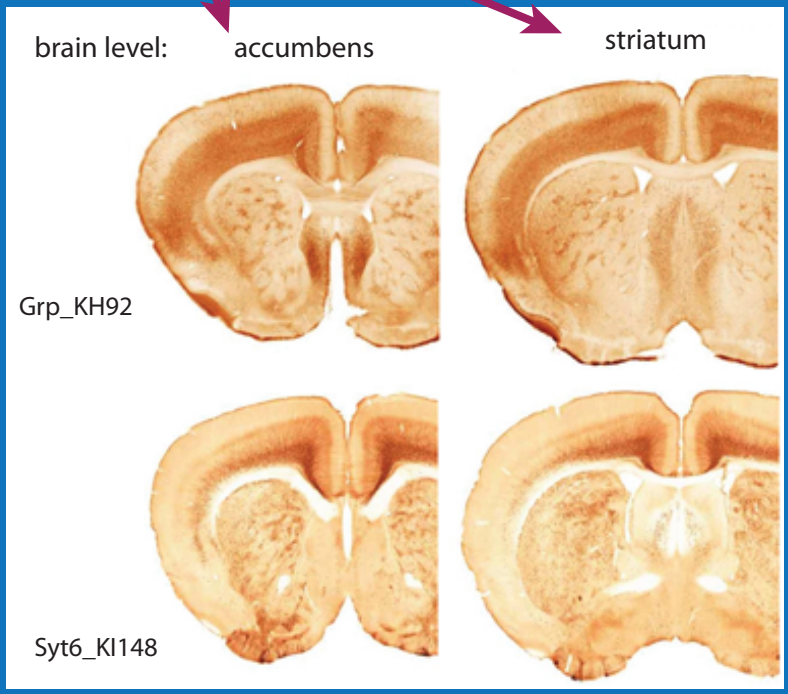


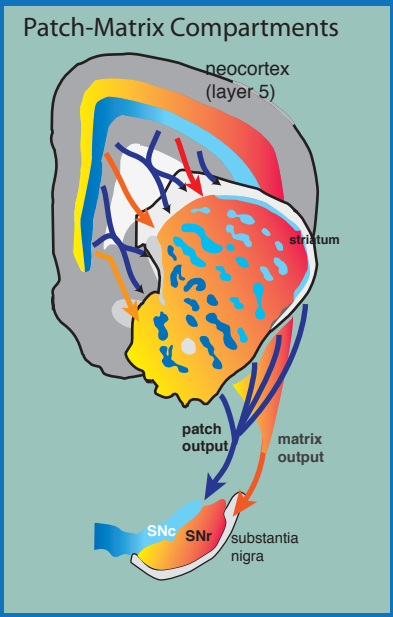
BAC-Cre driver lines from Basal Ganglia Circuit collection that label corticostriatal neurons

Rbp4_KL100: layer 5 cortico-striatal neurons (likely pyramidal tract corticostriatal neurons)
Grp26_KO250: layer 5 cortico-striatal neurons (likely intertelencephalic corticostriatal neurons)
Satb2_MO23: layer 5 cortico-striatal and layer 6 corticothalamic neurons









Striatal patch and matrix compartments are related to the laminar organization of the cortex and have different projection targets

Sublaminae of layer 5 corticostriatal project selectively to the patch compartment (deep layer 5) or matrix compartment (superficial layer 5)

Patch neurons project to the midbrain dopamine neurons in the substantia nigra pars compacta (SNc)
- this presumably involves Drd1a direct pathway neurons
- projections of Drd2 indirect pathway neurons are unknown

Matrix neurons that express Drd1a (direct pathway) project to the GPi and SNr
Matrix neurons that express Drd2 (indirect pathway) project to the GPe