Pharmacological multiple analysis of specific-subpopulation by applying of cell-labeling technique

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Our understanding of brain function under the drug treatment and pathology has been promoted by genetically encoded tools for labeling *neuronal subpopulation* and manipulating neuronal function. Recent studies have indicated that ventral tegmental area (VTA) dopamine (DA) neurons are heterogeneous in their properties. In the present study, we demonstrated that morphine (MRP)-responsive neurons were isolated from the VTA of c-Fos-EGFP/Rpl10a transgenic mice expressing an EGFP fused to *Rpl10a*, under the control of the *c-fos* promoter and purified using MACS and FACS. These experiences showed that systemic administration of MRP activated a subset of VTA neurons, including TH-positive DA neurons. Furthermore, using c-Fos-eNpHR mice, optical suppression of MRP-responsive VTA neurons significantly inhibited analgesic responses induced by systemic administration of MRP. These results suggest that the activation of MRP-responsive mesolimbic DA neurons partly modulates MRP-induced analgesia. The present findings provide evidence that labeling *neuronal subpopulation* and manipulating neuronal function using genetic engineering technology is very powerful tool for detecting functional neural circuits under drug treatment and disease conditions.