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Supplemental information

Extinction blunts paraventricular thalamic contributions to heroin relapse

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Supplemental information

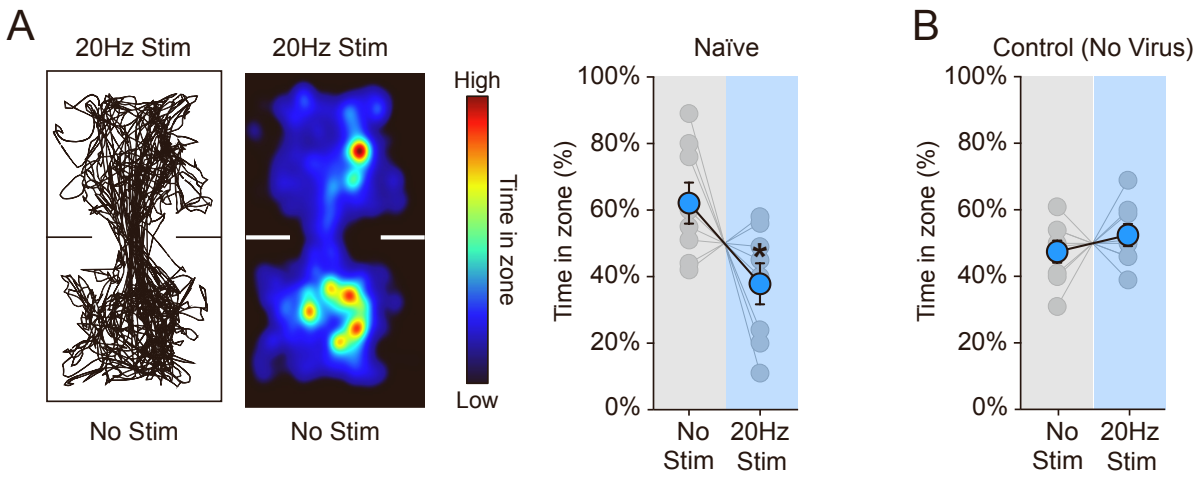

Figure S1: Optogenetic activation of PVT→NAc pathway induces aversion in naïve animals (related to Figure 2 and Figure 3). A) Example trace (left) and heatmap (middle) of real-time CPA test. Optogenetic activation (20Hz, 20ms) of the PTV→NAc pathway induced real-time CPA in naïve animals. **B)** Stimulation of PVT (20Hz, 20ms) in the absence of ChR2 has no effect in a real-time CPA test. * $p<0.05$ vs. no stim condition. Data are shown as mean ± SEM.

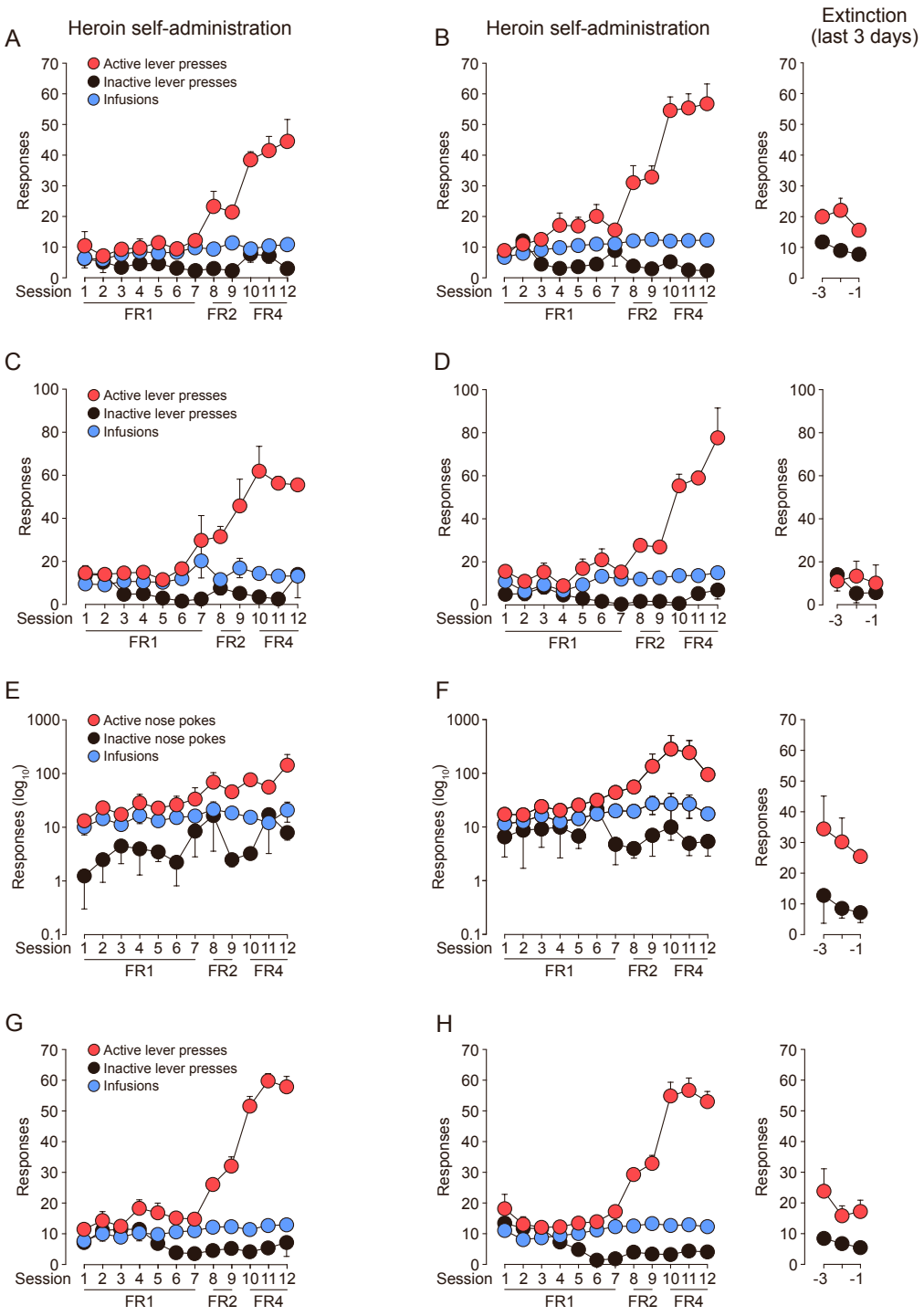

Figure S2. Heroin self-administration and extinction (related to Figure 2, Figure 3, Figure 4, Figure 5, and Figure S4). Heroin self-administration of the abstinence **(A)** and the extinction group **(B, left)** for the optogenetic experiments. Panel **B (right)** shows last 3 days of extinction training. Heroin self-administration of the abstinence **(C)** and the extinction group **(D, left)** for the field post-synaptic potential experiments. Panel **D (right)** shows last 3 days of extinction training. Heroin self-administration of the abstinence **(E)** and the extinction group **(F, left)** for the LTD experiments in the D2-eGFP mice. Panel **F (right)** shows last 3 days of extinction. Heroin self-administration of the abstinence **(G)** and the extinction group **(H, left)** for the chemogenetic experiments. Panel **H (right)** shows last 3 days of extinction training. Data are shown as mean ± SEM.

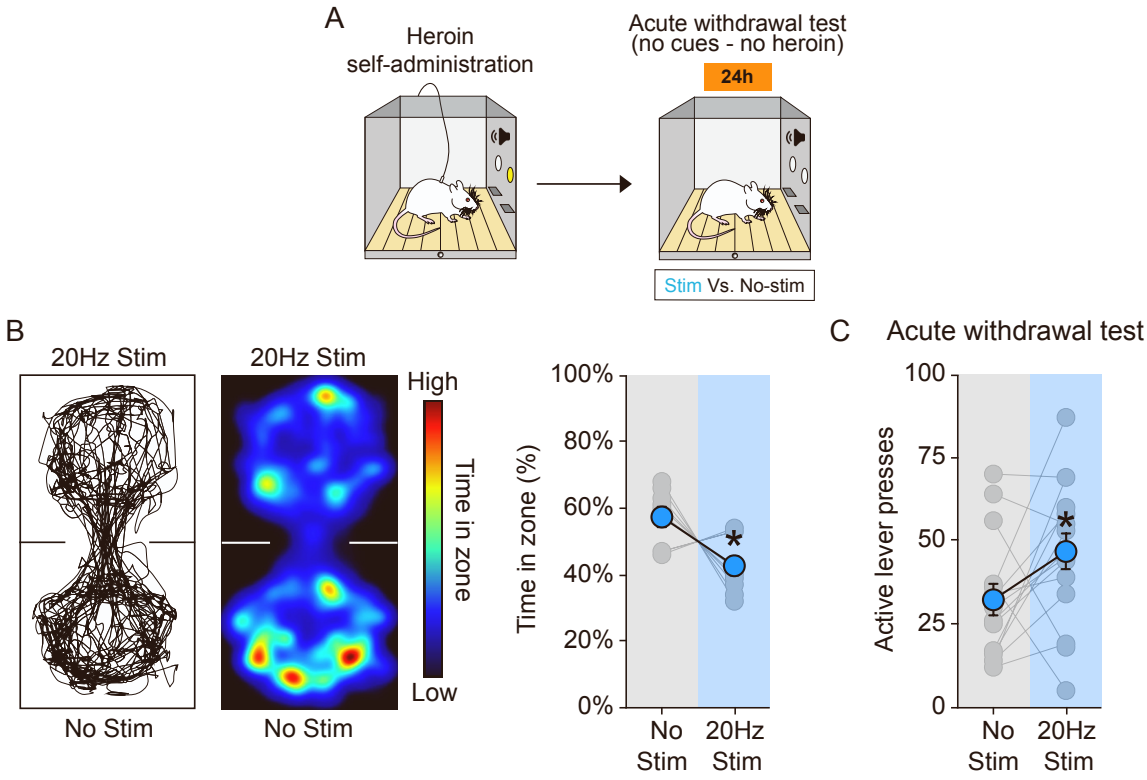

Figure S3: Optogenetic activation of the PVT→NAc pathway induces aversion and drives heroin seeking during early withdrawal from heroin self-administration (related to Figure 3). A) Timeline employed for the behavioral experiment. Optogenetic activation (20Hz, 20ms) of the PVT→NAc pathway induces aversion **(B)** and drives heroin seeking **(C)** during early (24 h) withdrawal from heroin self-administration. * p<0.05 vs. no stim condition. Data are shown as mean ± SEM.

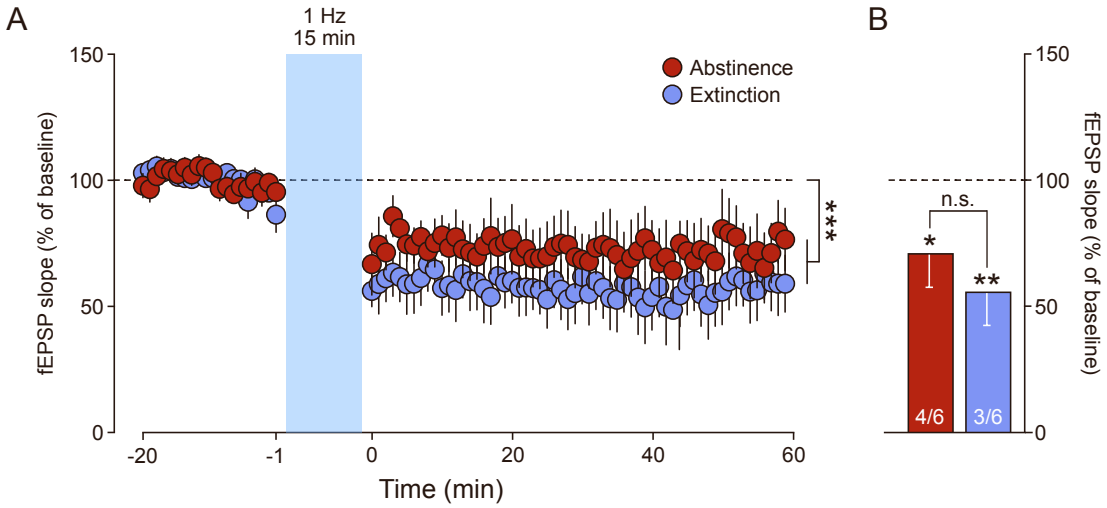

Figure S4: LTD stimulation protocol of ChR2-expressing PVT terminals in the NAc drives synaptic plasticity after extinction and abstinence from heroin self-administration (related to figure 4). A) Time course of optogenetic evoked field excitatory post-synaptic potential (fEPSP) slopes in NAc slices from abstinence and extinction animals (*** $p<0.001$, main effect of the time). **B)** Optogenetic stimulation (1 Hz - 900 pulses) of ChR2-expressing PVT terminals in the NAc induces LTD after abstinence and extinction from heroin self-administration (average of the last 20 min post-LTD; * $p<0.05$, ** $p<0.01$ vs baseline). Data are shown as mean ± SEM.