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## **Supplemental Information**

### **A Paranigral VTA Nociceptin Circuit that Constrains Motivation for Reward**

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**Table S1. Related to STAR Methods Section: Stereotaxic viral / optical fiber implant surgeries. List of viruses used in stereotaxic surgery**

<b>Virus</b>	<b>Amount</b>	<b>Coordinates</b>	<b>Source</b>
AAV5-EF1 $\alpha$ -DIO-hChR2-(H134R)-eYFP	500 nL	AP -3.4, ML 0.0, DV -4.75	The Hope Center Viral Core – Washington University at St. Louis
AAV5-EF1 $\alpha$ -DIO-eNpHR3.0-eYFP	500 nL	AP -3.4, ML 0.0, DV -4.75	UNC Vector Core
AAV1-EF1 $\alpha$ -DIO-TVA-mCherry: AAV1-EF1 $\alpha$ -DIO-RG (1:1 mixture)	350 nL	AP -3.2, ML $\pm$ 0.5, DV -4.8	UNC Vector Core
$\Delta$ G-rabies-GFP	350 nL	AP -3.2, ML $\pm$ 0.5, DV -4.8	Salk Institute
AAV2-FLEX-taCasp3-TEVp	500 nL	AP -3.4, ML 0.0, DV -4.8	UNC Vector Core
AAV5-hSyn-DIO-hM3Dq-mCherry	500 nL	AP -3.4, ML 0.0, DV -4.8	Addgene
AAV5-hSyn-DIO-hM4Di-mCherry	500 nL	AP -3.4, ML 0.0, DV -4.8	Addgene
AAV5-EF1 $\alpha$ -DIO-NOPR-eYFP	300 nL	AP -3.15, ML $\pm$ 0.5, DV -4.8	Bruchas Lab
AAV5-PGK-Cre	300 nL	AP -3.15, ML $\pm$ 0.5, DV -4.8	UNC Vector Core
AAV9-rTH-PI-Cre-SV40	300 nL	AP -3.15, ML $\pm$ 0.5, DV -4.8	Addgene, Penn Vector Core
retroAAV2-EF1 $\alpha$ -DIO-hChR2-(H134R)-eYFP	100 nL	AP -3.15, ML $\pm$ 0.5, DV -4.8	The Hope Center Viral Core – Washington University at St. Louis
AAV-DJ-EF1 $\alpha$ -DIO-GCaMP6f	470 nL	AP -3.4, ML $\pm$ 0.4 DV -4.8	Stanford University Gene Vector and Viral Core
AAV8-bacTRAP	500 nL	AP -3.4, ML 0.0, DV -4.75	UNC Vector Core

**Table S2. Related to Figure 4: pnVTA<sup>Pnoc</sup> TRAP: Genes of Interest**

Gene Symbol	Gene Name	Class	log <sub>2</sub> (CPM)
Pnoc	Prepronociceptin	Neuropeptide	3.989
PDYN	Preprodynorphin	Neuropeptide	1.778
PENK	Preproenkephalin	Neuropeptide	1.178
NPY	Neuropeptide Y	Neuropeptide	0.189
CARTPT	Cocaine and amphetamine regulated transcript	Neuropeptide	-0.176
SST	Somatostatin	Neuropeptide	-1.607
CCK	Cholecystokinin	Neuropeptide	-2.16
POMC	Proopiomelanocortin	Neuropeptide	-3.339
Slc6a3	Dopamine Transporter; dopamine marker	Channel/Transporter	3.539
VAT1	vesicle amine transport protein 1 homolog (T californica)	Channel/Transporter	3.142
Slc17a6	Vglut2; solute carrier family 17 member 6	Channel/Transporter	2.82
Cacna2d1	calcium channel, voltage-dependent, alpha2/delta subunit 1	Channel/Transporter	2.614
Slc17a8	Vglut3; solute carrier family 17 member 8	Channel/Transporter	-0.023
Slc18a2	solute carrier family 18 (vesicular monoamine transporter 2), member 2	Channel/Transporter	-0.092
Slc17a7	Vglut1; solute carrier family 17 member 7	Channel/Transporter	-1.74
Hcrtr1	Hypocretin(orexin) receptor 1	Receptor	6.067
Ntsr1	Neurotensin receptor 1	Receptor	5.324
Gabrq	Gamma-aminobutyric acid (GABA) A receptor, subunit theta	Receptor	4.464
Htr7	5-hydroxytryptamine (serotonin) receptor 7	Receptor	2.958
Oprm1	Mu opioid receptor 1	Receptor	2.275
NPY1R	Neuropeptide Y receptor 1	Receptor	1.454
Oprk1	Kappa opioid receptor 1	Receptor	1.295
Htr1a	5-hydroxytryptamine (serotonin) receptor 1A	Receptor	1.263
Chrna4	cholinergic receptor, nicotinic, alpha polypeptide 4	Receptor	-0.087
Htr2c	5-hydroxytryptamine (serotonin) receptor 2C	Receptor	-0.526
Htr2a	5-hydroxytryptamine (serotonin) receptor 2A	Receptor	-0.873
Htr4	5-hydroxytryptamine (serotonin) receptor 4	Receptor	-1.206
Oprl1	opiod receptor like 1	Receptor	-1.289
Chrna5	cholinergic receptor, nicotinic, alpha polypeptide 5	Receptor	-2.752
Chrna7	cholinergic receptor, nicotinic, alpha polypeptide 7	Receptor	-2.752
Chrna3	cholinergic receptor, nicotinic, alpha polypeptide 3	Receptor	-3.407
Htr5A	5-hydroxytryptamine (serotonin) receptor 5A	Receptor	-3.635
FEV	Fifth Ewing Variant Protein	Transcription factor	3.946
GAD1	glutamic acid decarboxylase 1	Other	1.013
GAD2	glutamic acid decarboxylase 2	Other	-0.275
TH	Tyrosine hydroxylase; dopamine marker	Other	-0.767
Aldh1L1	Aldehyde Dehydrogenase 1 Family Member L1 (astrocyte marker)	Other	-3.137
Ache	Acetylcholinesterase	Other	-3.329
Gfap	glial fibrillary acidic protein (astrocyte marker)	Other	-4.026
FA2H	fatty acid 2-hydroxylase (oligodendrocyte marker)	Other	-5.502