

Supplementary Fig. 1 | Projections of LPB glutamatergic neurons throughout the brain.

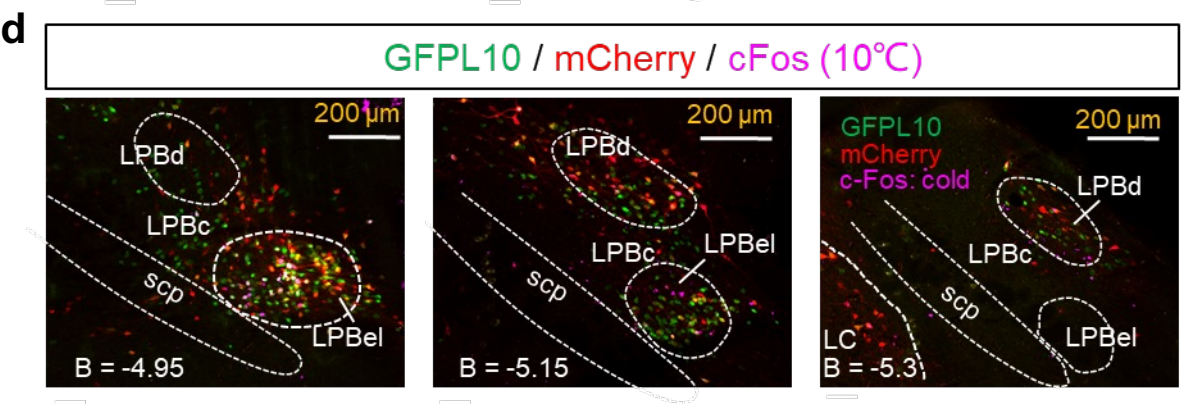
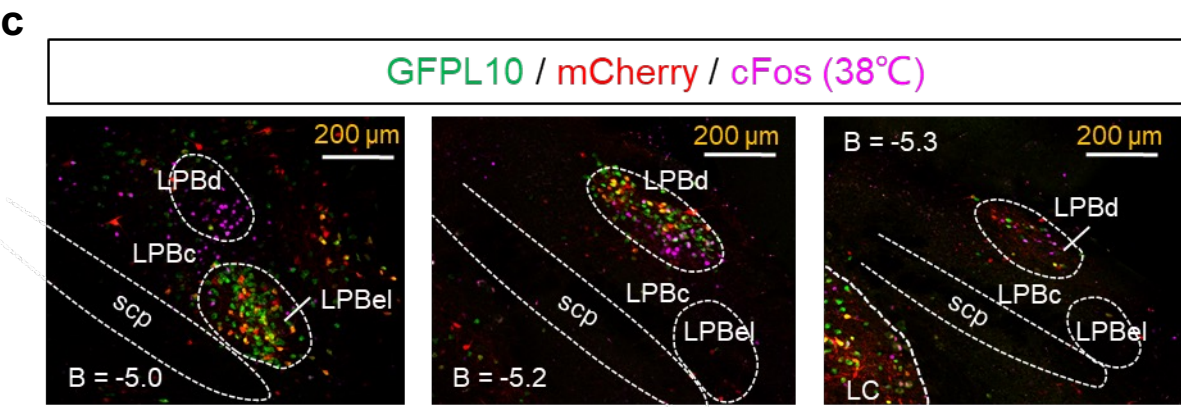
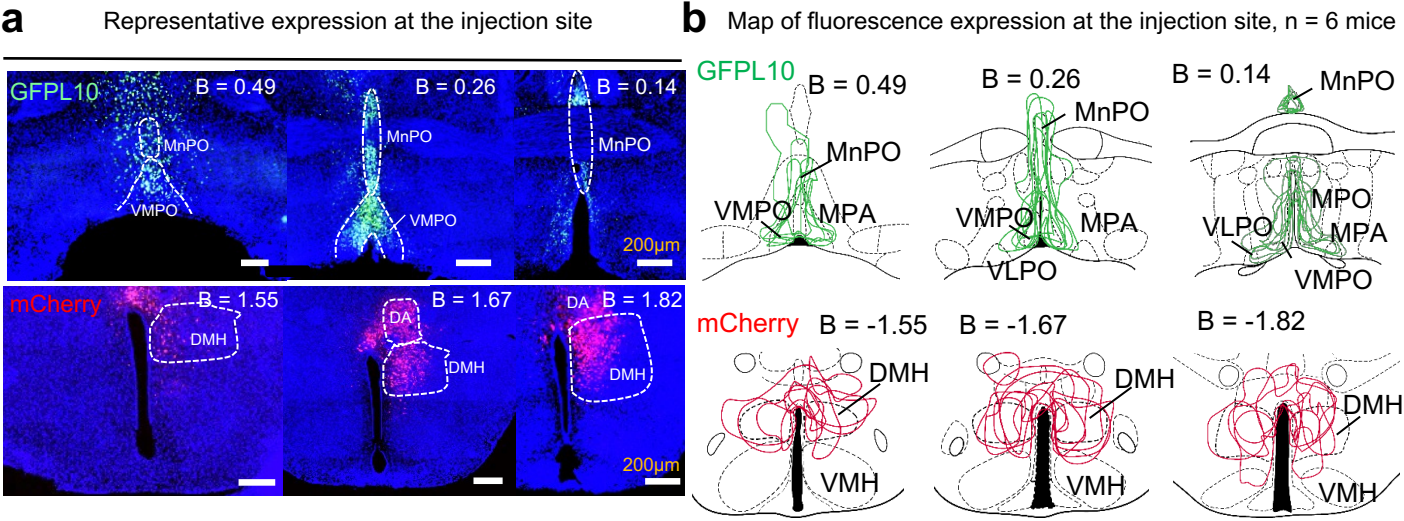
(a) The axonal projection pattern of LPB glutamatergic neurons throughout the brain, revealed by anterograde tracing AAVs. Injection sites of AAV9-DIO-ChR2-eYFP in the LPB are indicated in the figure. Thicker lines indicate stronger eYFP expression.

(b) Representative images are showing ChR2-eYFP expression in the injection sites. This experiment was repeated at least 10 times independently with similar results.

(c) Representative images are showing ChR2-eYFP expression in axonal terminals at various brain sites. This experiment was repeated at least 10 times independently with similar results.

B, bregma; LPBC, lateral parabrachial nucleus, central part; LPBD, lateral parabrachial nucleus, dorsal part; LPBE, lateral parabrachial nucleus, external part; LPBV, lateral parabrachial nucleus, ventral part; LPBI, lateral parabrachial nucleus, internal part; LDTg, laterodorsal tegmental nucleus; LDTgV, laterodorsal tegmental nucleus, ventral part; KF, Kolliker-Fuse nucleus; MPB, medial parabrachial nucleus; LC, locus coeruleus; MVeMC, medial vestibular nucleus, magnocellular part; MVePC, medial vestibular nucleus, parvicellular part; icp, inferior cerebellar peduncle; scp, superior cerebellar peduncle; SuVe, superior vestibular nucleus. PAG, periaqueductal gray matter; SC, superior colliculus; RVM, rostral ventromedial medulla; PnO, the oral part of pontine reticular nucleus; TH, thalamus; Po, posterior thalamic nuclear group; POA, preoptic nucleus; PaF, parafascicular thalamic nucleus; SPF, subparafascicular thalamic nucleus; VPM, ventral posteromedial thalamic; ZID, zona incerta, dorsal part; DLPAG, dorsolateral periaqueductal gray; DMPAG, dorsomedial periaqueductal gray; LPAG, lateral periaqueductal gray; InG, intermediate gray layer of the superior colliculus; InWh, intermediate white layer of the superior colliculus; DpG, deep gray layer of the superior colliculus; Gi, gigantocellular reticular nucleus; GiA, gigantocellular reticular nucleus, alpha part; LPGi, lateral paragigantocellular nucleus; rmg, raphe magnus nucleus; LPO, lateral preoptic area; StHY, striohypothalamic nucleus; MPA, medial preoptic area; MPOM, medial preoptic nucleus, medial part; SIB, substantia innominata, basal part; HDB, nucleus of the horizontal limb of the diagonal band; D3V, dorsal 3rd ventricle; PVT, paraventricular thalamic nucleus.

Supplementary Fig. 2 | Mapping the collateral projections of LPB^{Vglut2} neurons to the POA (MnPO & VMPO) and the DMH.



Supplementary Fig. 2 | Mapping the collateral projections of LPB^{Vglut2} neurons to the POA (MnPO & VMPO) and the DMH.

(a) Representative expression of GFP (AAV-Retro-DIO-GFPL10) and mCherry (AAV-Retro-DIO-mCherry) in the injection sites. AAV-Retro-DIO-GFPL10 was injected in the VMPO & MnPO of Vglut2-IRES-Cre mice (n = 6 mice) and AAV-Retro-DIO-mCherry was injected in the DMH of Vglut2-IRES-Cre mice (n = 6 mice). The expression boundaries of each mouse were overlaid in the right as indicated.

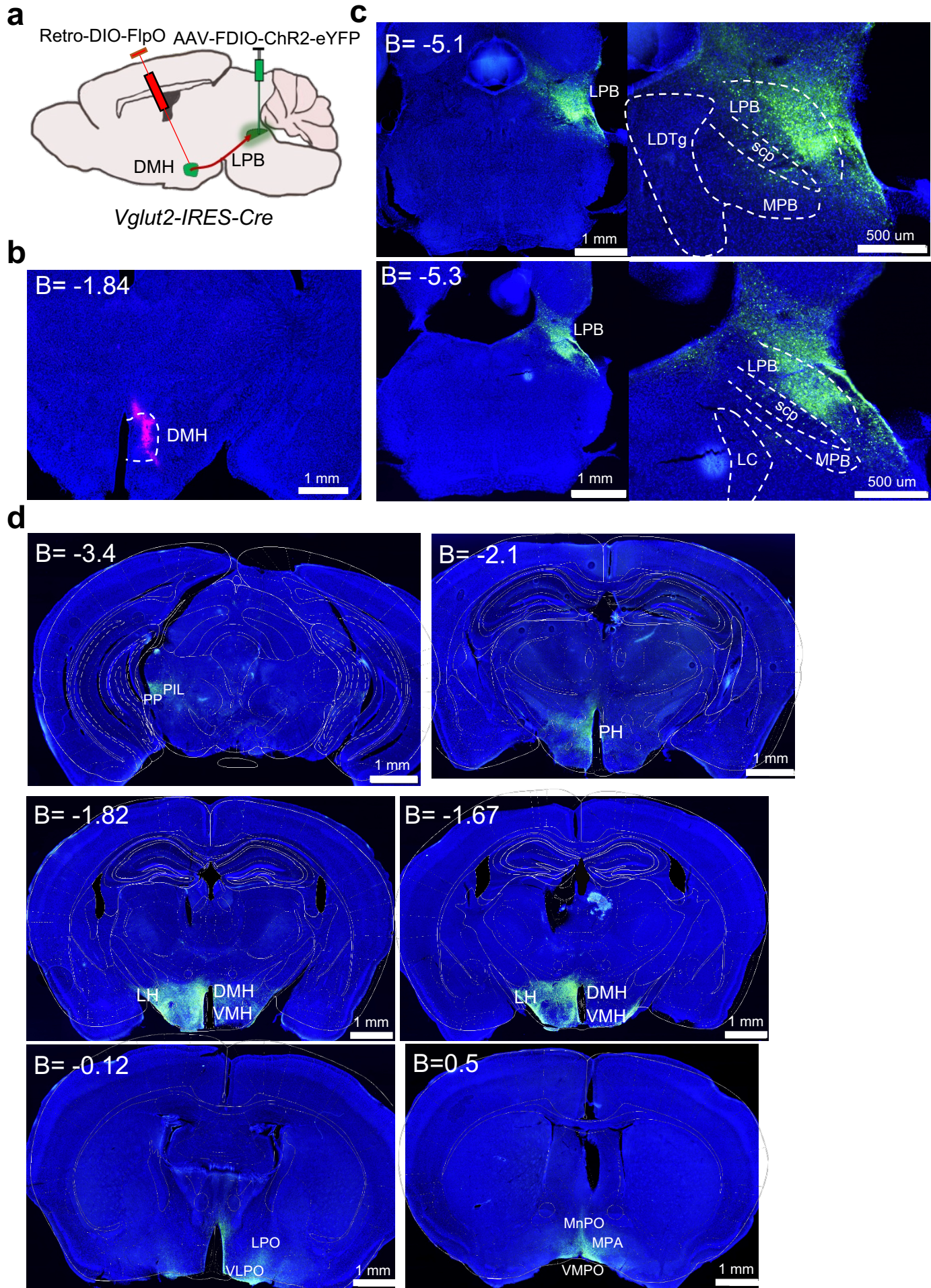
(b) Map of fluorescence expression at the injection sites from (a). The expression boundaries of each mouse were overlaid and showed together as indicated (n = 6 mice).

(c) Representative images showing the overlapping between POA- and DMH-projecting LPB^{Vglut2} neurons and warm-activated cFos at different bregma sites. Mice were exposed to warm stimuli (38°C, 2 hrs) before sacrificing for cFos immunostaining. The overlapping ratios were indicated in Fig. 1e. A total of 924 cFos⁺ neurons from 3 mice were scored.

(d) Representative images showing the overlapping between POA/DMH-projecting LPB neurons and cold-activated cFos immunoactivity at different bregma sites. Mice were exposed to cold stimuli (10°C, 2 hrs) before sacrificing for cFos immunostaining. The overlapping ratios were indicated in Fig. 1g. A total of 693 cFos⁺ neurons from 3 mice were scored.

B, bregma; LPBc, lateral parabrachial nucleus, central part; LPBd, lateral parabrachial nucleus, dorsal part; LPBel, lateral parabrachial nucleus, external and internal part; LC, locus coeruleus; scp, superior cerebellar peduncle; DMH, dorsomedial hypothalamus nucleus; DA, dorsal hypothalamus area; VMH, ventromedial hypothalamus nucleus; MnPO, median preoptic area; VLPO, ventrolateral preoptic area; MPA, medial preoptic area; MPO, medial preoptic nucleus; VMPO, ventromedial preoptic area.

Supplementary Fig. 3 | Projection pattern of DMH-projecting LPB^{Vglut2} neurons throughout the brain.



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(a) Scheme for mapping the axonal projections of DMH-projecting LPB^{Vglut2} neurons. For labeling DMH-projecting LPB^{Vglut2} neurons, retrograde AAVs carrying Cre-dependent FlpO were injected in the DMH, which drove the expression of FlpO-dependent ChR2-eYFP in the LPB. A red tracer (CTB647) was co-injected into the DMH to indicate the injection sites.

(b) Representative image showing the injection sites in the DMH viewed by red tracer (CTB647). This experiment was repeated at least 3 times independently with similar results.

(c) Representative images showing ChR2-eYFP expression in DMH-projecting LPB^{Vglut2} neurons in the LPB. This experiment was repeated at least 3 times independently with similar results.

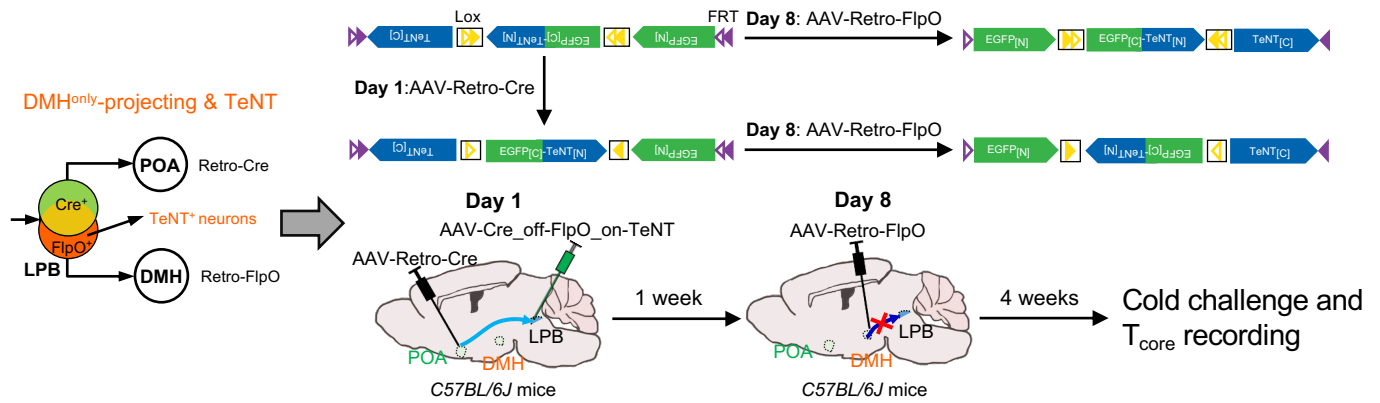
(d) Representative images are showing ChR2-eYFP expression in axonal terminals at various brain sites. This experiment was repeated at least 3 times independently with similar results.

B, bregma; LPB, lateral parabrachial nucleus; LDTg, laterodorsal tegmental nucleus; MPB, medial parabrachial nucleus; LC, locus coeruleus; scp, superior cerebellar peduncle; POA, preoptic nucleus; DMH, dorsomedial hypothalamus; VMH, ventromedial hypothalamus; LH, lateral hypothalamus; PH, poster hypothalamus; LPO, lateral preoptic area; MnPO, median preoptic nucleus; VMPO, ventromedial preoptic nucleus; MPA, medial preoptic area; VLPO, ventrolateral preoptic nucleus; PP, peripeduncular nucleus; PIL, posterior intralaminar thalamic nucleus.

Supplementary Fig. 4 | Phenotypes associated with blocking of DMH^{only}-projecting or POA^{only}-projecting LPB neurons.

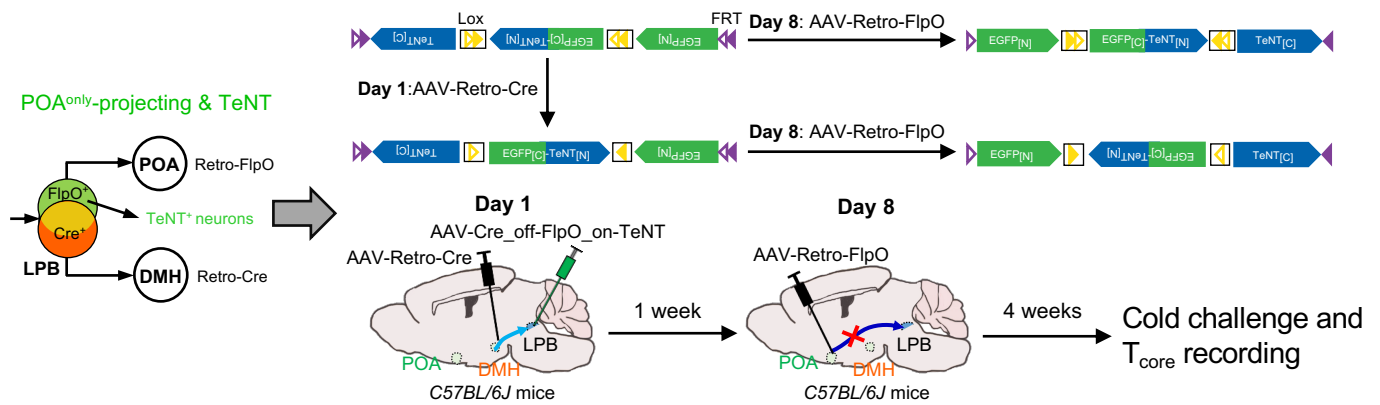
a

Blocking DMH^{only}-projecting LPB Neurons



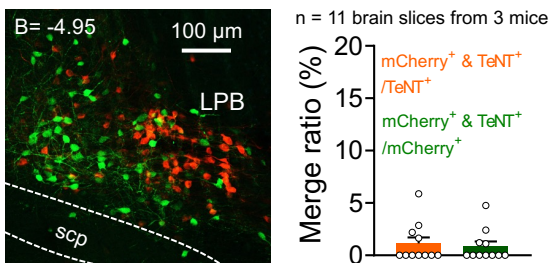
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Blocking POA^{only}-projecting LPB Neurons



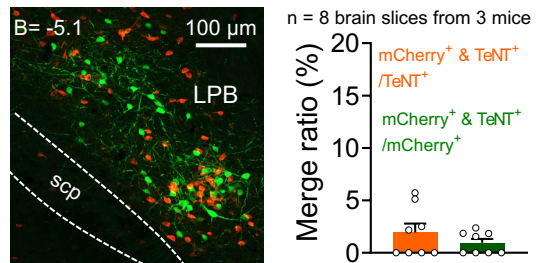
c

LPB mCherry (POA-projecting) / TeNT (DMH^{only}-projecting)

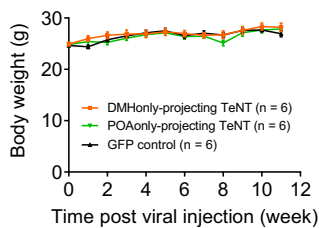


d

LPB mCherry (DMH-projecting) / TeNT (POA^{only}-projecting)

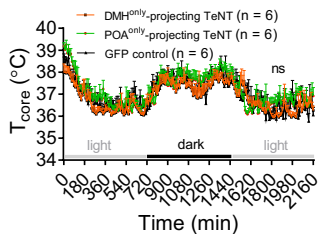


e



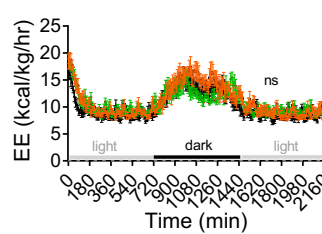
f

Basal T_{core} (T_a=29 °C)



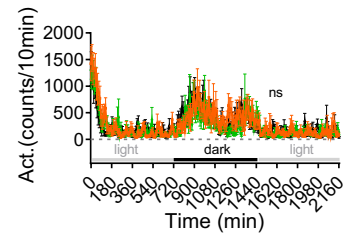
g

Basal EE (T_a=29 °C)



h

Basal Physical Activity (T_a=29 °C)



Supplementary Fig. 4 | Phenotypes associated with blocking of DMH^{only}-projecting or POA^{only}-projecting LPB neurons.

(a) The scheme to block LPB neurons that projected to the DMH but did not collaterally project to the POA (DMH^{only}-projecting LPB neurons). On day 1, the retrograde traveling AAV-Retro-hSyn-Cre virus was injected into the POA (MnPO & VMPO) and Cre_{off}-FlpO_{on}-TeNT (AAV9-hSyn-Cre_{off}-FlpO_{on}-EGFP-T2A-TeNT) injected in the LPB of C57BL/6J mice. Thus, AAV-Retro-Cre would travel to the LPB to turn off TeNT in turning off the TeNT expression in POA-projecting LPB neurons, thus unblocking POA-projecting LPB neurons. On day 8, AAV-Retro-hSyn-FlpO virus was injected into the DMH, which then traveled to the LPB to turn on the TeNT expression in DMH-projecting but not co-projecting LPB neurons (DMH^{only}-projecting LPB neurons). Cre_{off}-FlpO_{on}-EGFP (AAV9-hSyn-Cre_{off}-FlpO_{on}-EGFP) was used as the control for Cre_{off}-FlpO_{on}-TeNT.

(b) The scheme to block LPB neurons that projected to the POA but did not collaterally project to the DMH (POA^{only}-projecting LPB neurons). On day 1, the retrograde traveling AAV-Retro-hSyn-Cre virus was injected into the DMH and Cre_{off}-FlpO_{on}-TeNT (AAV9-hSyn-Cre_{off}-FlpO_{on}-EGFP-T2A-TeNT) injected in the LPB of C57BL/6J mice. Thus, AAV-Retro-Cre would travel to the LPB to turn off TeNT in turning off the TeNT expression in DMH-projecting LPB neurons, thus unblocking DMH-projecting LPB neurons. On day 8, AAV-Retro-hSyn-FlpO virus was injected into the POA (MnPO & VMPO), which then traveled to the LPB to turn on the TeNT expression in POA-projecting but not co-projecting LPB neurons (POA^{only}-projecting LPB neurons). The same control was used as in (a).

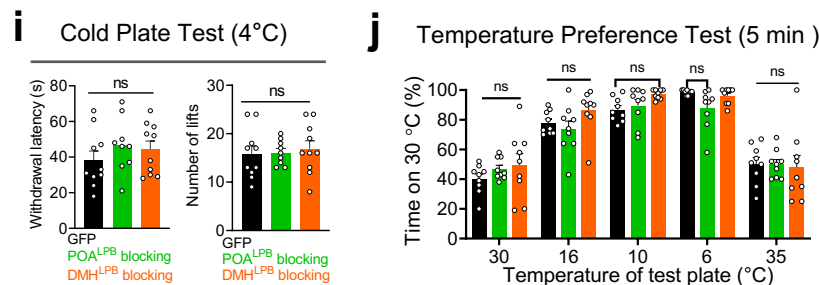
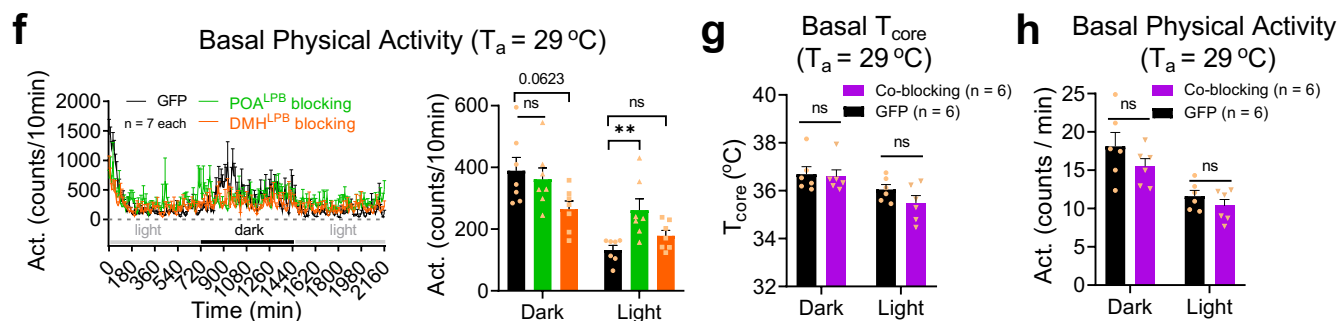
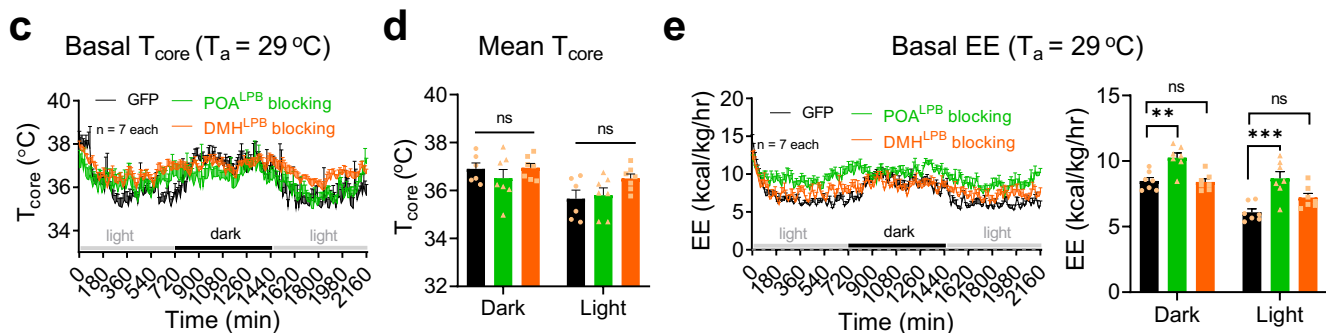
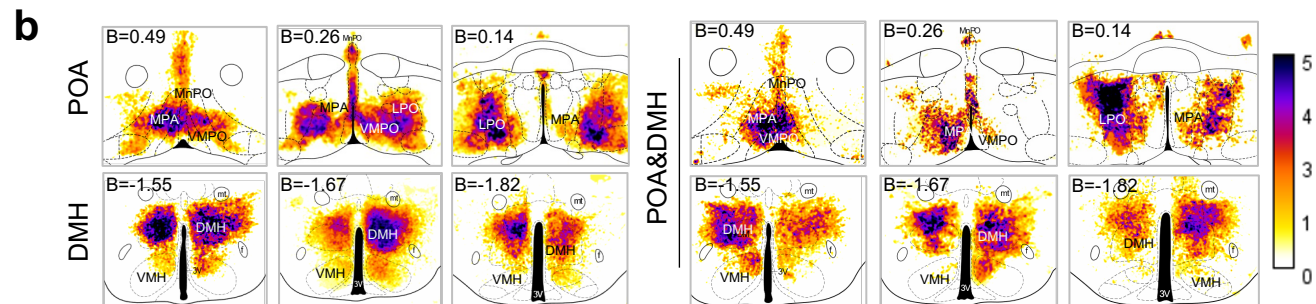
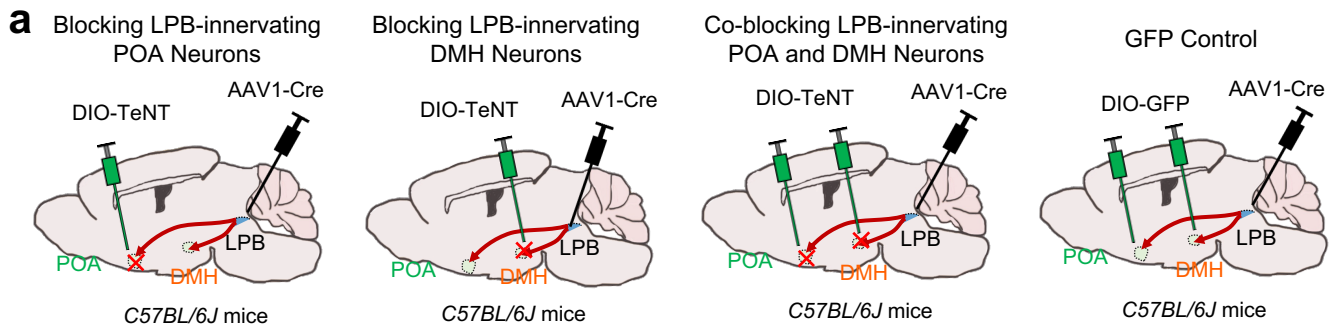
(c) Representative images showing the little overlapping between POA-projecting LPB neurons (mCherry⁺) and DMH^{only}-projecting LPB neurons (TeNT⁺). To label the POA-projecting LPB neurons, AAV-hSyn-DIO-mCherry was co-injected with Coff/Fon-TeNT-EGFP in the LPB in (a) so that AAV-Retro-Cre injected in the POA would travel to the LPB to turn on mCherry expression. Scale bar, 100 μ m. The overlapping ratios were quantified in the right panel (11 brain slices from 3 mice).

(d) Representative images showing the little overlapping between DMH-projecting LPB neurons (mCherry⁺) and POA^{only}-projecting LPB neurons (TeNT⁺). To label the DMH-projecting LPB neurons, AAV-hSyn-DIO-mCherry was co-injected with Coff/Fon-TeNT-EGFP in the LPB in (b) so that AAV-Retro-Cre injected in the DMH would travel to the LPB to turn on mCherry expression. Scale bar, 100 μ m. The overlapping ratios were quantified in the right panel (8 brain slices from 3 mice).

(e-h) Changes of body weight (e), basal T_{core} (f), basal energy expenditure (g) and basal physical activity (h) at thermoneutral temperature (f-h) after blocking the DMH^{only}-projecting LPB neurons or POA^{only}-projecting LPB neurons, as indicated (n = 6 mice each).

LPB, lateral parabrachial nucleus; POA, preoptic area; DMH, dorsomedial hypothalamic nucleus; TeNT, Tetanus toxin. All data are shown as mean \pm sem. The p-values are calculated based on two-way ANOVA (e-h). ns, not significant. Source data are provided as a Source data file.

Supplementary Fig. 5 | Heatmaps of TeNT expression and baseline measurement after blocking LPB-innervating POA or DMH neurons.



Supplementary Fig. 5 | Heatmaps of TeNT expression and baseline measurement after blocking LPB-innervating POA or DMH neurons.

(a) The scheme to block LPB-innervating POA (mainly MnPO, VMPO, MPA, and LPO) neurons, LPB-innervating DMH neurons, LPB-innervating POA and DMH Neurons (Co-blocking), and GFP control. The anterograde transsynaptic Cre carried by AAV1 (AAV1-hSyn-Cre) was injected in the LPB, which drove the expression of AAV9-hEF1a-DIO-mCherry-P2A-TeNT injected in the POA (POA^{LPB} blocking), the DMH (DMH^{LPB} blocking), or both (co-blocking), as indicated. AAV9-hSyn-DIO-GFP was injected as the control (GFP), where AAV1-hSyn-Cre was injected in the LPB and AAV9-hSyn-DIO-GFP was injected in both the POA and DMH.

(b) Heatmaps of TeNT expression at different Bregma sites from all experimental mice. POA^{LPB} blocking, n = 9 mice; DMH^{LPB} blocking, n = 10 mice; co-blocking, n = 6 mice. The relative scale for the expression intensity (measured by fluorescence intensity) was shown in the right.

(c-f) Changes of basal T_{core} (c-d), basal energy expenditure (e), and basal physical activity (f) at thermoneutral temperature (29°C) after blocking LPB-innervating DMH neurons (DMH^{LPB} blocking) or LPB-innervating POA neurons (POA^{LPB} blocking), as indicated (n = 7 each).

(g-h) Changes of basal T_{core} (g) and basal physical activity (h) at thermoneutral temperature (29°C) after blocking LPB-innervating POA and DMH neurons (Co-blocking), as indicated (n = 6 each).

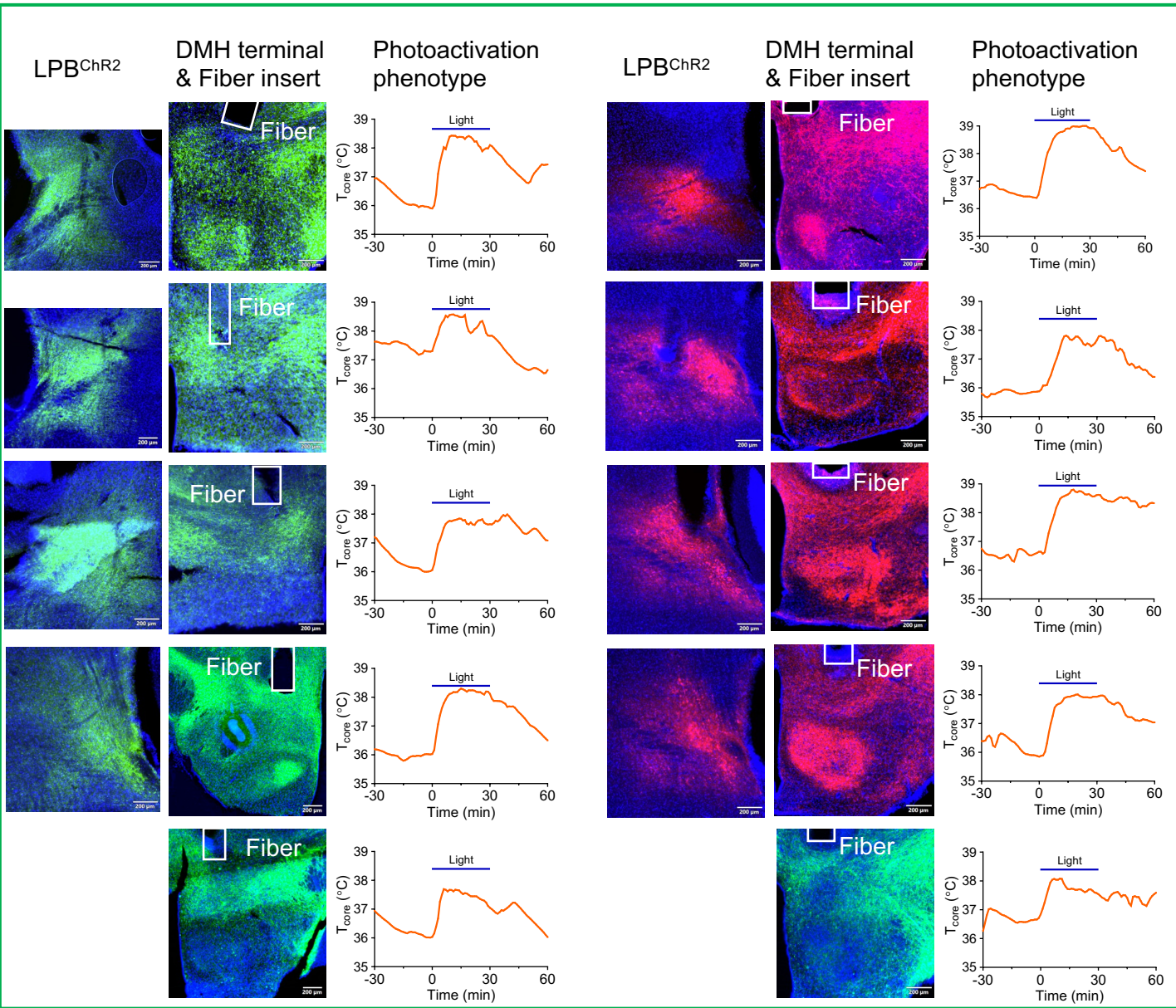
(i) Withdrawal latency and the number of lifts in the cold plate test (4°C) after blocking LPB-innervating POA/DMH neurons (n = 10 for GFP and DMH^{LPB} blocking group; n = 9 for POA^{LPB} blocking group).

(j) Changes in preference to 30°C versus 35/16/10/6°C after blocking LPB-innervating POA/DMH neurons (n = 9 mice each).

All data are shown as mean \pm sem. The p-values are calculated based on one-way ANOVA (d-f, i-j) or unpaired t-test (g-h). The p-values are calculated based on statistical tests in Supplementary Table 2. *p \leq 0.05; **p \leq 0.01; ***p \leq 0.001; ns, not significant. Source data are provided as a Source data file.

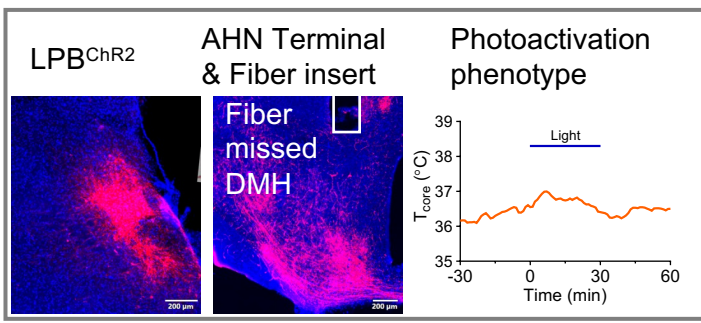
Supplementary Fig. 6 | Detailed viral expressions, fiber insert positions, and T_{core} changes of the manipulation of the LPB^{Vglut2}→DMH projection that hit or missed the targets.

a



b

One mouse that missed target of photoactivation

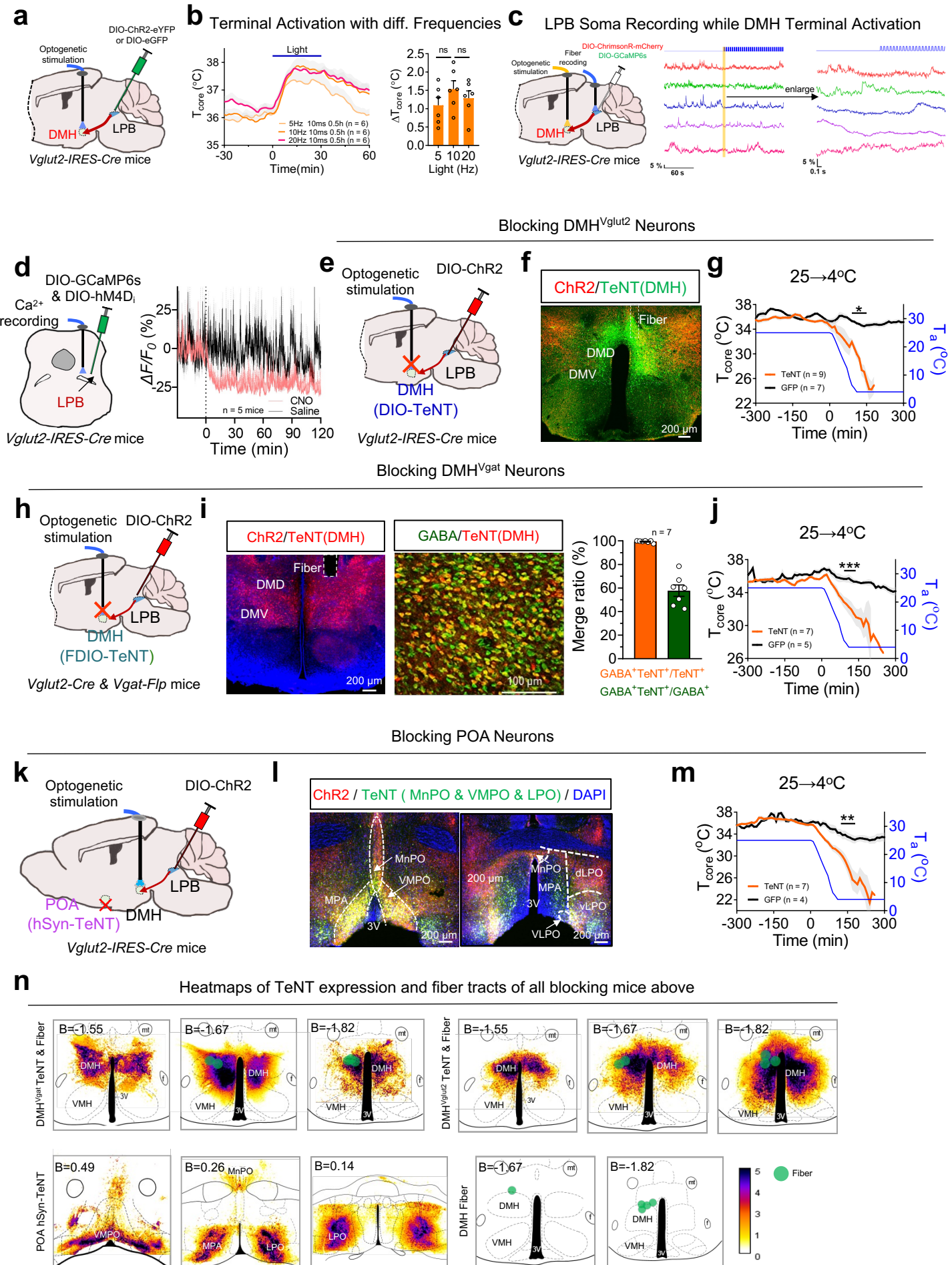


Supplementary Fig. 6 | Detailed viral expressions, fiber insert positions, and T_{core} changes of the manipulation of the $\text{LPB}^{\text{Vglut2}} \rightarrow \text{DMH}$ projection that hit or missed the targets.

(a) Representative images demonstrating the expression of ChR2 in $\text{LPB}^{\text{Vglut2}}$ neurons, fiber insert positions and resulting T_{core} changes after photoactivation $\text{LPB}^{\text{Vglut2}} \rightarrow \text{DMH}$ that hit the target. This experiment was repeated at least 10 times independently with similar results.

(b) Data from one mouse exhibiting missed fiber insert positions and T_{core} changes following photoactivation. AHN, anterior hypothalamic nucleus. This experiment was repeated at least 1 times independently with similar results. Source data are provided as a Source data file.

Supplementary Fig. 7 | Phenotypes associated with neural blocking of POA neurons, DMH^{Vglut2} neurons and DMH^{Vgat} neurons.

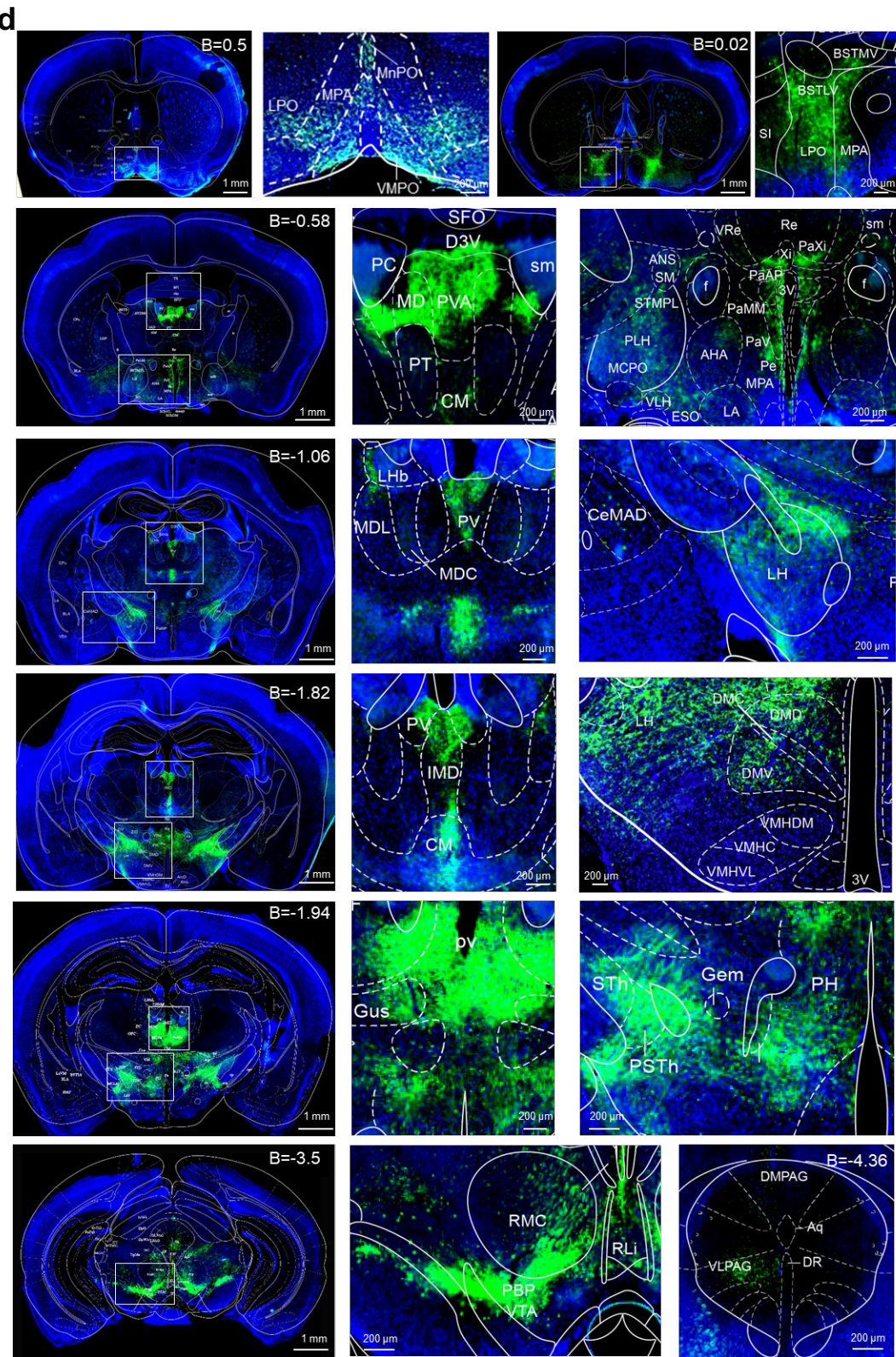
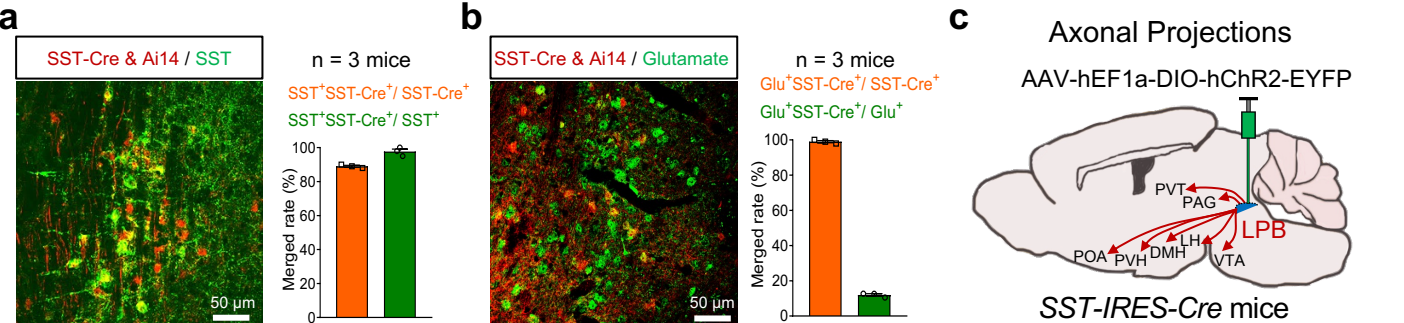


Supplementary Fig. 7 | Phenotypes associated with neural blocking of POA neurons, DMH^{Vglut2} neurons and DMH^{Vgat} neurons.

- (a) Scheme of optogenetic activation of glutamatergic (Vglut2+) LPB neural terminals in the DMH.
- (b) Changes of T_{core} after 30 min photoactivation of LPB^{Vglut2} neural terminals in the DMH (n = 6 each). Laser pattern: 473 nm, 12mW, Hz as indicated, 30 min.
- (c) Scheme for simultaneously expressing the GCaMP6s and ChrimsonR in the LPB, then the DMH terminals were simultaneously activated using a 589nm laser and Ca^{2+} activity was recorded in the LPB (left panel). No obvious calcium signal changes were recorded in LPB after activating DMH's terminals (n = 5 mice). The blue pulse line indicates light stimulation (right panel). Light pattern: 589 nm, 6 mW, 10 Hz, 10 ms, 2-s on followed by 2-s off, with the cycles repeating for 10 min.
- (d) Scheme for calcium photometry of LPB^{Vglut2} neurons before and after chemogenetic inhibition. AAVs carrying inhibitory chemogenetic tool hM4D(Gi) (AAV9-EF1 α -DIO-hM4D(Gi)-mCherry) and GCaMP6s (AAV9-hSyn-DIO-GCaMP6s) were co-injected in the LPB of Vglut2-Cre mice to block neural activity and record calcium dynamics of LPB^{Vglut2} neurons, respectively. The optical fiber for calcium photometry was implanted in the LPB (left panel). Calcium dynamics of LPB^{Vglut2} neurons before and after chemogenetic inhibition. CNO was injected (i.p., 10mg/kg) at t = 0 min. $\Delta F/F_0$ represents the change in GCaMP6s fluorescence from the mean level (right panel, n = 5 mice).
- (e) Scheme for blocking DMH^{Vglut2} neurons using TeNT. AAV5-hSyn-DIO-GFP-P2A-TeNT was injected in the DMH of Vglut2-IRES-Cre mice to block DMH^{Vglut2} neurons.
- (f) Representative TeNT expression in the DMH^{Vglut2} neurons. This experiment was repeated at least 9 times independently with similar results.
- (g) Changes of T_{core} during cold challenges (25 \rightarrow 4 $^{\circ}$ C) after blocking DMH^{Vglut2} neurons (TeNT, n = 9 mice; GFP, n = 7 mice, a total of 10 mice were injected for each group, 1 mouse for TeNT and 3 mice for GFP were excluded from the final analysis due to missed injections or death).
- (h) Scheme for blocking DMH^{Vgat} neurons using TeNT. AAV9-hEF1 α -FDIO-mCherry-P2A-TeNT was injected in the DMH of Vglut2-IRES-Cre & Vgat-T2A-FlpO mice to block DMH^{Vgat} neurons.
- (i) Representative TeNT expression in DMH^{Vgat-FlpO} neurons and the colocalization of TeNT and GABA immunostaining. The overlapping ratios were quantified in the right. This experiment was repeated at least 7 times independently with similar results.
- (j) Changes of T_{core} during cold challenges (25 \rightarrow 4 $^{\circ}$ C) after blocking DMH^{Vgat} neurons (TeNT, n = 7 mice; GFP, n = 5 mice, a total of 10 mice for TeNT and 5 mice for GFP were injected for each group, 3 mice for TeNT were excluded from the final analysis due to missed injections or death).
- (k) Scheme for blocking POA neurons using TeNT. AAV9-hSyn-eGFP-2A-TeNT were injected in the POA of Vglut2-IRES-Cre mice to block POA neurons.
- (l) Representative TeNT expression in the POA (MnPO, VMPO, MPA and LPO) neurons. This experiment was repeated at least 7 times independently with similar results.
- (m) Changes of T_{core} during cold challenges (25 \rightarrow 4 $^{\circ}$ C) after blocking bulk POA neurons (TeNT, n = 7 mice; GFP, n = 4 mice, a total of 10 mice for TeNT and 5 mice for GFP were injected for each group, 3 mice for TeNT and 1 mouse for GFP were excluded from the final analysis due to missed injections or death).
- (n) Heatmaps of TeNT expression and fiber tracts (shown as green dots, each dot represent one mouse) at different Bregma sites from all experimental mice. DMH^{Vglut2} TeNT, n = 9 mice; DMH^{Vgat} TeNT, n = 7 mice; POA TeNT, n = 7 mice. The relative scale for the expression intensity was shown in the right.

All data are shown as mean \pm sem. The p-values are calculated based on two-way ANOVA statistical tests. The p-values are calculated based on statistical tests in Supplementary Table 2. **p \leq 0.01; ***p \leq 0.001. Source data are provided as a Source data file.

Supplementary Fig. 8 | Properties and whole-brain axonal projections of LPB^{SST} neurons.



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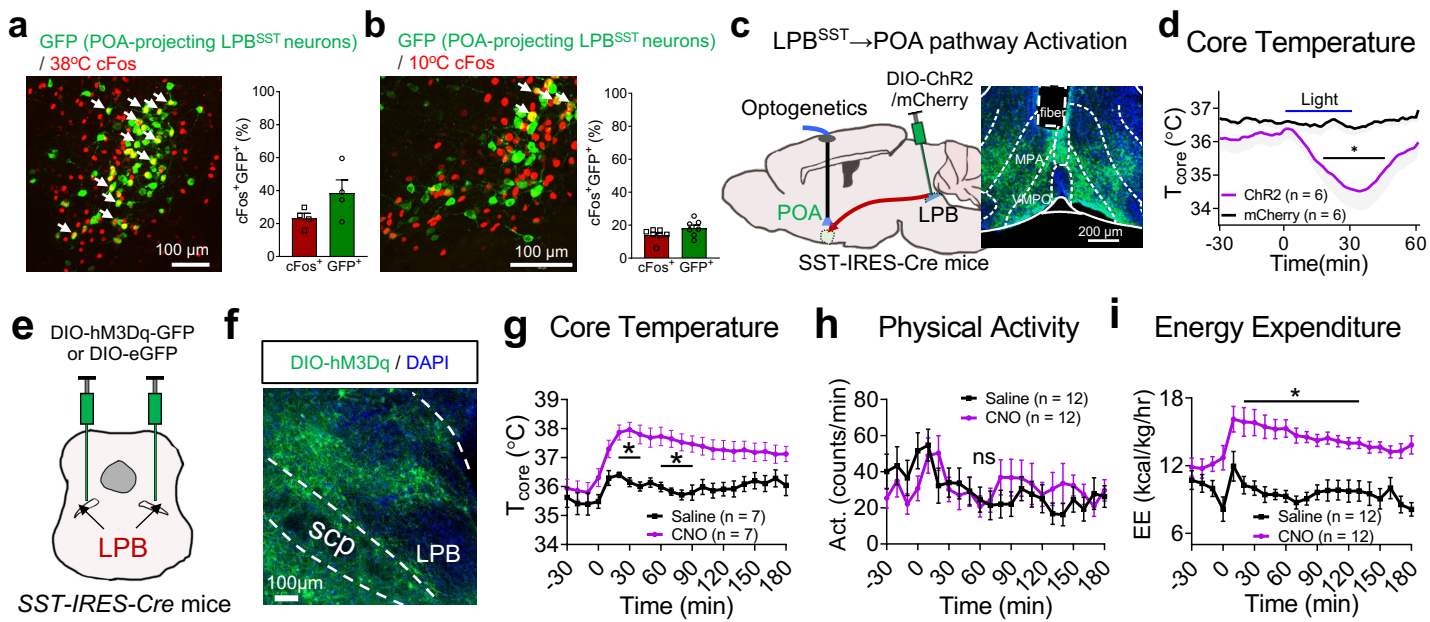
(a-b) Overlap between SST-IRES-Cre labeled neurons (Tdt⁺) in the LPB and the following immuno-positive neurons: SST peptide (a) and glutamate (b). SST-IRES-Cre mice were crossed with Ai14 (Rosa-CAG-LSL-tdTomato-WPRE) to label SST-IRES-Cre in the LPB. Overlap ratios are shown on the right of each panel (n = 3 mice each). All data are shown as mean \pm sem. Source data are provided as a Source data file.

(c) The axonal projection pattern of LPB^{SST} neurons throughout the brain, revealed by anterograde tracing AAVs. Injection sites of AAV9-DIO-ChR2-eYFP in the LPB were indicated in the figure. Thicker lines indicated stronger eYFP expressions.

(d) Representative images showing ChR2-eYFP expression in axonal terminals at various brain sites. This experiment was repeated at least 8 times independently with similar results.

AHA, anterior hypothalamic, anterior; B, bregma; BNST, bed nucleus of the stria terminalis; SFO, subfornical organ; sm, stria medullaris of the thalamus; PVA, paraventricular thalamic nucleus, anterior part; PT, paratenia thalamic nucleus; PaAP, paraventricular hypothalamic nucleus, anterior parvic; PaMM, paraventricular hypothalamic nucleus, medial magnocellular part; MDL, mediodorsal thalamic nucleus, lateral part; LHb, lateral habenular nucleus; Pe, periventricular hypothalamic nucleus; PaV, paraventricular hypothalamic nucleus, ventral part; PV, paraventricular thalamic nucleus; BLA, basolateral amygdaloid nucleus, anterior part; CeMAD central amygdaloid nucleus, medial division, anterodorsal part; MD, intermediodorsal thalamic nucleus; DM, central medial thalamic nucleus; PH, posterior hypothalamic nucleus; VMH, ventromedial hypothalamic nucleus; VMHC, ventromedial hypothalamic nucleus, central part; VMHDM, ventromedial hypothalamic nucleus, dorsomedial part; VMHVL, ventromedial hypothalamic nucleus, ventrolateral part; SC, superior colliculus; PSTh parasubthalamic nucleus; STh subthalamic nucleus; POA, preoptic nucleus; Gem, gemini hypothalamic nucleus; Gus gustatory thalamic; VPM, ventral posteromedial thalamic; DMC, dorsomedial hypothalamic nucleus, compact part; DMD, dorsomedial hypothalamic nucleus, dorsal part; RMC, red nucleus, magnocellular part; ZID, zona incerta, dorsal part; Aq, aqueduct(Sylvius); DLPAG, dorsolateral periaqueductal gray; DMPAG, dorsomed periaqueductal; InG, intermediate gray layer of the superior colliculus; LPO, lateral preoptic area; MPA, medial preoptic area; SIB, substantia innominata, basal part; HDB, nucleus of the horizontal limb of the diagonal band; D3V, dorsal 3rd ventricle; PVT, paraventricular thalamic nucleus.

Supplementary Fig. 9 | Phenotypes associated with activation of LPB^{SST} neurons and LPB^{SST}→POA pathway.



(a-b) Overlap between POA-projecting LPB^{SST} neurons and heat-induced cFos (a) or cold-induced cFos (b) (n = 3 mice each, 1-2 slices for each mouse). To label POA-projecting LPB^{SST} neurons, we injected retrograde AAVs carrying Cre-dependent GFPL10 (AAV-Retro-CAG-Flex-GFPL10) in the VMPO of SST-IRES-Cre mice, which drove the expression of GFPL10 in the LPB. Merged cells were indicated by white arrows.

(c) Design to activate the LPB^{SST}→POA projection via photostimulating of LPB^{SST} & ChR2 terminals in the VMPO. The representative expression of ChR2-eYFP in the POA is shown in right. This experiment was repeated at least 6 times independently with similar results.

(d) Changes in T_{core} after photoactivation of the LPB^{SST}→POA projection. (n = 6 mice each). Light pattern: 473 nm, 6 mW, 10 Hz, 10 ms, 2-s on followed by 2-s off, with the cycles repeating for 30 min.

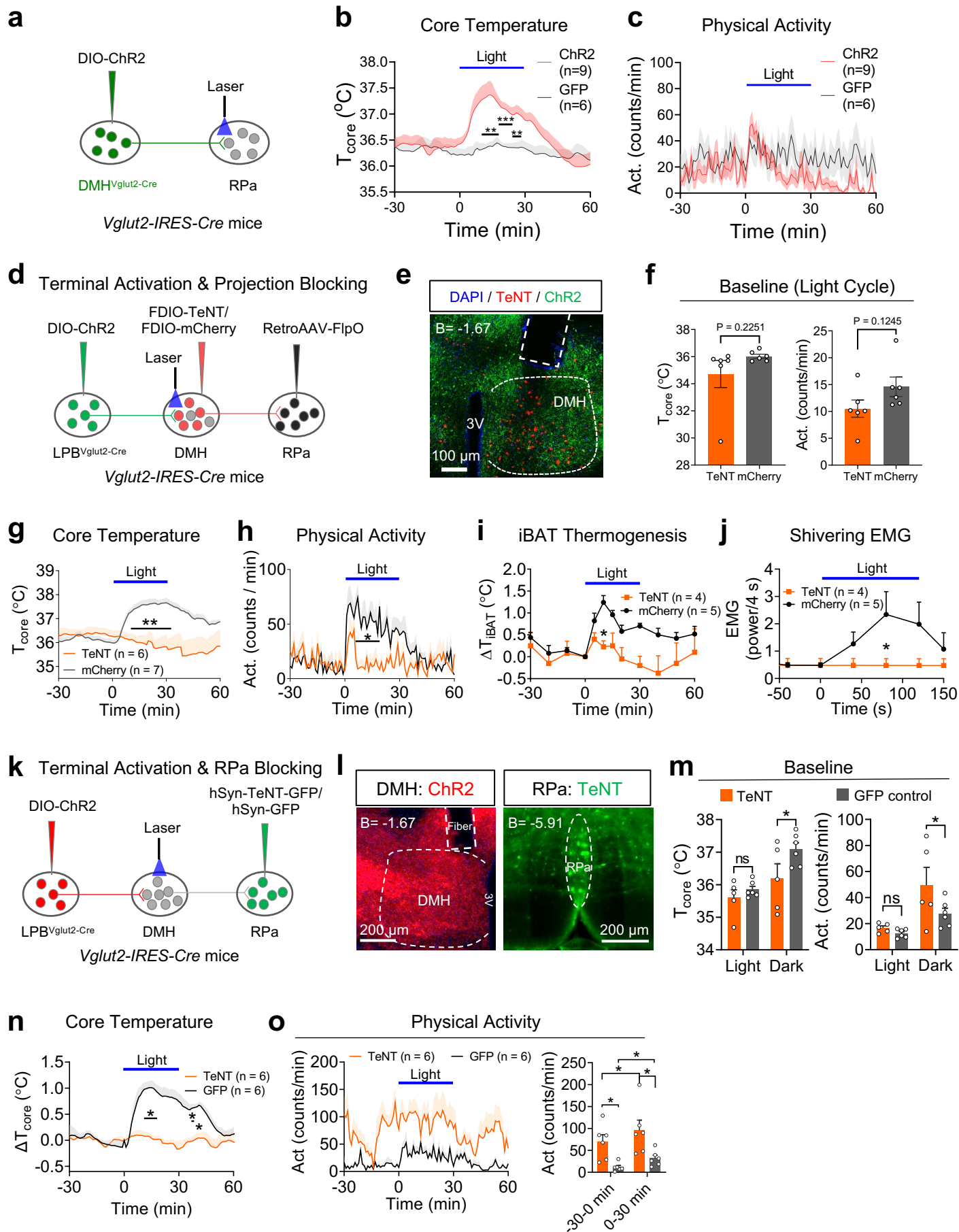
(e) Scheme for chemogenetic activation of LPB^{SST} neurons using hM3D_q. AAVs carrying hM3D_q (AAV9-hSyn-DIO-hM3D(G_q)-eGFP) were injected in the LPB to activate LPB^{SST} neurons.

(f) Representative expression of hM3D_q in LPB^{SST} neurons. This experiment was repeated at least 7 times independently with similar results.

(g-i) Changes of T_{core} (g), physical activity (h), and energy expenditure (i) after chemogenetic activation of LPB^{SST} neurons (n = 12 mice each). CNO was injected (i.p., 2.5 mg/kg) at t = 0 min.

All data are shown as mean ± sem. The p-values are calculated based on RM two-way ANOVA. The p-values are calculated based on statistical tests in Supplementary Table 2. *p ≤ 0.05; ns, not significant. Source data are provided as a Source data file.

Supplementary Fig. 10 | The DMH→RPa pathway is downstream of the LPB→DMH pathway in regulating cold defense.



Supplementary Fig. 10 | The DMH→RPa pathway is downstream of the LPB→DMH pathway in regulating cold defense.

(a) Activating the DMH^{Vglut2}→RPa projection via photoactivation of DMH^{Vglut2 & ChR2} neural terminals in the RPa. AAVs carrying Cre-dependent ChR2 (AAV9-hEF1a-DIO-hChR2-EYFP) were injected into the DMH of Vglut2-IRES-Cre mice. An optical fiber was implanted above the RPa and used for optogenetic activation of neural terminals. AAV9-hSyn-Flex-GFP was used as the control.

(b-c) Changes of T_{core} (b) and physical activity (c) after photoactivation of DMH^{Vglut2 & ChR2} neural terminals in the RPa (ChR2, n = 9 mice; GFP, n = 6 mice). Light pattern: 473 nm, 12 mW, 10 Hz, 10 ms, 2-s on followed by 2-s off, with the cycles repeating for 30 min.

(d) Photoactivation of LPB^{Vglut2} terminals in the DMH while blocking RPa-projecting DMH neurons. To block RPa-projecting DMH neurons, retrograde AAVs carrying FlpO (AAV-Retro-hSyn-FlpO) were injected in the RPa, which drove the expression of FlpO-dependent TeNT (AAV9-hEF1a-FDIO-mCherry-2A-TeNT) in the DMH.

(e) Representative images of LPB^{Vglut2 & ChR2} terminals in the DMH (green) and TeNT expression from RPa-projecting DMH neurons (red). This experiment was repeated at least 6 times independently with similar results.

(f) Average basal T_{core} and physical activity after blocking RPa-projecting DMH neurons during the light cycle at $T_a = 26^\circ\text{C}$ (n = 6 mice each).

(g-j) Changes in T_{core} (g), physical activity (h), T_{IBAT} (i), and nuchal muscle EMG (j) in response to photoactivation of LPB^{Vglut2} terminals in the DMH while blocking of RPa-projecting DMH neurons (g-h: TeNT, n = 6 mice; mCherry, n = 7 mice; i-j: TeNT, n = 4 mice; mCherry, n = 5 mice). Light pattern: 473 nm, 6 mW, 10 Hz, 10 ms, 2-s on followed by 2-s off, with the cycles repeating for 30 min in (g-i) and 120 s in (j).

(k) Photoactivation of LPB^{Vglut2} terminals in the DMH while blocking RPa neurons.

(l) Representative images of LPB^{Vglut2 & ChR2} terminals (red) in the DMH (left panel) and TeNT expression (green) in RPa neurons (right panel). Scale bar, 200 μm . This experiment was repeated at least 6 times independently with similar results.

(m) Average basal T_{core} and physical activity after blocking RPa neurons during the dark and light cycle at $T_a = 26^\circ\text{C}$ (TeNT, n = 5 mice; GFP, n = 6 mice).

(n-o) Changes in ΔT_{core} (n) and physical activity (o) in response to photoactivation of LPB^{Vglut2} terminals in the DMH while blocking of RPa neurons (n = 6 for each group). Light pattern: 473 nm, 6 mW, 10 Hz, 10 ms, 2-s on followed by 2-s off, with the cycles repeating for 30 min. Note, RPa blocking caused compulsive-like circling behavior at the basal level.

LPB, lateral parabrachial nucleus; POA, preoptic area; DMH, dorsomedial hypothalamic nucleus. RPa, raphe pallidus nucleus. All data are the mean \pm SEM, (f,m) was analyzed by unpaired t-test, and (b-c, g-j, n-o) were analyzed by two-way RM ANOVA. The p-values are calculated based on statistical tests in Supplementary Table 2. ns, not significant; * $p \leq 0.05$; ** $p \leq 0.01$. Source data are provided as a Source data file.

Supplementary Table 1. Summary of TRAP-seq data

gene id	gene name	log2FC	Pvalue	Qvalue
ENSMUSG(Irgm2		-7.44759	2.14E-10	6.69E-08
ENSMUSG(Bank1		-6.87598	4.46E-05	0.002274
ENSMUSG(Ptgr1		-6.47846	1.98E-06	0.000164
ENSMUSG(Gm7694		-6.46253	2.15E-06	0.000176
ENSMUSG(Pdzph1		-6.39189	3.85E-05	0.002021
ENSMUSG(Gm42798		-6.23682	8.28E-05	0.003779
ENSMUSG(Spi1		-6.19002	6.18E-10	1.68E-07
ENSMUSG(Pkd2l1		-6.18733	1.08E-07	1.46E-05
ENSMUSG(Spef2		-6.17151	6.75E-06	0.000471
ENSMUSG(Nrk		-6.0115	0.000261	0.009605
ENSMUSG(Mpp4		-5.94979	3.55E-10	1.06E-07
ENSMUSG(Gm38260		-5.90297	0.000265	0.009693
ENSMUSG(Pdlim1		-5.82376	4.38E-15	6.13E-12
ENSMUSG(Fgf2		-5.77165	8.43E-06	0.000559
ENSMUSG(Igf2		-5.75527	2.45E-08	4.11E-06
ENSMUSG(Serpinb8		-5.71814	6.70E-05	0.003187
ENSMUSG(Paqr5		-5.69368	0.000115	0.004956
ENSMUSG(Pcdhgb8		-5.68369	7.38E-06	0.000504
ENSMUSG(Ppl		-5.63137	0.001025	0.027926
ENSMUSG(Eya4		-5.59893	7.89E-06	0.00053
ENSMUSG(Gm38103		-5.5608	0.000274	0.009949
ENSMUSG(Echdc3		-5.45174	5.67E-06	0.000407
ENSMUSG(Hcls1		-5.45124	6.97E-06	0.000482
ENSMUSG(Gmfg		-5.41435	0.001098	0.029465
ENSMUSG(Rhod		-5.40237	1.76E-06	0.000149
ENSMUSG(Cd33		-5.39427	7.41E-05	0.003455
ENSMUSG(Ppp1r36		-5.36677	0.000886	0.024922
ENSMUSG(Hey2		-5.34546	6.61E-07	6.54E-05
ENSMUSG(Tnfaip8l2		-5.31581	3.52E-05	0.00189
ENSMUSG(Gm37233		-5.30637	0.002285	0.049782
ENSMUSG(Gm5864		-5.28825	2.68E-08	4.41E-06
ENSMUSG(Plekhg2		-5.25784	0.002285	0.049782
ENSMUSG(Car5b		-5.19257	1.85E-05	0.0011
ENSMUSG(Tmem173		-5.18847	0.000153	0.006322
ENSMUSG(Bin2		-5.11976	1.45E-07	1.87E-05
ENSMUSG(Dmbx1		-4.98144	4.52E-07	4.83E-05
ENSMUSG(Sox14		-4.90977	5.69E-06	0.000408
ENSMUSG(mt-Tv		-4.90011	1.69E-06	0.000144
ENSMUSG(Slc32a1		-4.89588	3.89E-07	4.27E-05
ENSMUSG(Icam1		-4.88452	0.000252	0.009318
ENSMUSG(Fcer1g		-4.87666	4.53E-08	7.07E-06
ENSMUSG(Gcnt1		-4.84018	0.000225	0.00854
ENSMUSG(Hvcn1		-4.82402	7.01E-05	0.003289
ENSMUSG(Hmgcs2		-4.81701	8.07E-07	7.79E-05
ENSMUSG(Lrrc74b		-4.81344	0.001643	0.039235
ENSMUSG(Ocln		-4.79672	5.16E-08	7.82E-06

ENSMUSG(mt-Tk	-4.76499	8.10E-06	0.000541
ENSMUSG(Aif1l	-4.75666	4.52E-12	2.38E-09
ENSMUSG(Slc39a8	-4.7466	3.26E-06	0.00025
ENSMUSG(Lefty1	-4.74602	0.000387	0.013094
ENSMUSG(Ecm2	-4.73379	2.50E-06	0.0002
ENSMUSG(Arap1	-4.68947	9.10E-10	2.32E-07
ENSMUSG(Ttc23	-4.68796	3.32E-06	0.000253
ENSMUSG(Iltifb	-4.68095	0.002248	0.04918
ENSMUSG(Arhgap11a	-4.67462	0.000296	0.010596
ENSMUSG(Hoxc4	-4.67017	0.000512	0.016105
ENSMUSG(Tm4sf4	-4.66833	0.000884	0.024922
ENSMUSG(Sp7	-4.66647	0.000206	0.007986
ENSMUSG(B230344G1	-4.62213	0.00049	0.015604
ENSMUSG(P2ry6	-4.60613	0.000317	0.011205
ENSMUSG(Cd53	-4.59888	5.00E-07	5.22E-05
ENSMUSG(Lrp2	-4.58444	0.001348	0.034044
ENSMUSG(Klh6	-4.56208	0.000144	0.006027
ENSMUSG(Stard8	-4.55192	9.96E-06	0.000644
ENSMUSG(Ptprc	-4.54928	9.50E-05	0.004223
ENSMUSG(Wdr72	-4.5244	0.001238	0.031966
ENSMUSG(Xlr	-4.50983	0.001154	0.030514
ENSMUSG(Fcgr3	-4.49788	1.70E-06	0.000144
ENSMUSG(Tst	-4.49005	9.48E-14	8.96E-11
ENSMUSG(Sp100	-4.48555	0.001114	0.029647
ENSMUSG(Gm43201	-4.47573	0.000603	0.018342
ENSMUSG(Ehd2	-4.45892	7.49E-07	7.32E-05
ENSMUSG(Fli1	-4.45312	2.98E-05	0.001639
ENSMUSG(C3ar1	-4.4439	6.35E-05	0.003075
ENSMUSG(Papss2	-4.43494	8.52E-08	1.17E-05
ENSMUSG(Crybb1	-4.43079	8.56E-07	8.19E-05
ENSMUSG(Parp3	-4.4267	8.83E-07	8.35E-05
ENSMUSG(Clec5a	-4.42595	0.000483	0.015433
ENSMUSG(Gm43336	-4.41015	0.002107	0.046816
ENSMUSG(Sds	-4.40776	9.28E-05	0.004152
ENSMUSG(Uaca	-4.4052	0.000186	0.0074
ENSMUSG(Adhfe1	-4.40426	9.43E-14	8.96E-11
ENSMUSG(Slc2a10	-4.3782	5.97E-05	0.002921
ENSMUSG(mt-Tr	-4.36436	2.70E-09	5.90E-07
ENSMUSG(Anxa2	-4.36182	1.20E-12	8.02E-10
ENSMUSG(Chdh	-4.33143	7.21E-06	0.000496
ENSMUSG(Tagln	-4.32682	1.17E-05	0.000741
ENSMUSG(Lum	-4.32508	5.12E-06	0.000373
ENSMUSG(mt-Tg	-4.32118	1.27E-08	2.35E-06
ENSMUSG(Aif1	-4.32084	6.82E-07	6.72E-05
ENSMUSG(Ptpn14	-4.32068	3.06E-05	0.00168
ENSMUSG(Slfn2	-4.2985	6.62E-06	0.000462
ENSMUSG(Epx	-4.29555	0.000158	0.006478

ENSMUSGC Kcne11	-4.28482	3.93E-12	2.10E-09
ENSMUSGC Ctss	-4.27994	1.77E-14	2.27E-11
ENSMUSGC Lyz2	-4.25997	2.96E-07	3.44E-05
ENSMUSGC Acsbg1	-4.24254	5.86E-11	2.30E-08
ENSMUSGC Lfng	-4.23337	5.16E-07	5.33E-05
ENSMUSGC Fcrls	-4.208	3.52E-05	0.00189
ENSMUSGC Myh11	-4.15938	0.000982	0.026961
ENSMUSGC Pdgfrl	-4.15571	0.001433	0.035487
ENSMUSGC Grap	-4.15377	1.21E-05	0.000765
ENSMUSGC Abca9	-4.14629	0.000278	0.010087
ENSMUSGC Trh	-4.13092	0.000168	0.006802
ENSMUSGC Lat2	-4.13068	0.000225	0.00854
ENSMUSGC Gm38309	-4.11985	0.000224	0.008515
ENSMUSGC mt-Td	-4.11559	0.000135	0.005725
ENSMUSGC Nat1	-4.10457	4.38E-06	0.000326
ENSMUSGC Hist1h2bc	-4.10243	6.47E-16	1.83E-12
ENSMUSGC Acss3	-4.10213	1.41E-05	0.00087
ENSMUSGC C1qb	-4.09494	4.08E-15	5.95E-12
ENSMUSGC Pdlim2	-4.09274	3.79E-15	5.79E-12
ENSMUSGC Abi3	-4.09271	3.25E-06	0.00025
ENSMUSGC Phgdh	-4.09044	1.35E-16	5.44E-13
ENSMUSGC S100a13	-4.08811	5.54E-08	8.26E-06
ENSMUSGC Fam107a	-4.0677	5.02E-13	3.84E-10
ENSMUSGC Txnip	-4.06504	1.83E-05	0.00109
ENSMUSGC Gm7901	-4.0647	3.08E-14	3.30E-11
ENSMUSGC Plin3	-4.06399	1.37E-15	2.90E-12
ENSMUSGC Fabp7	-4.04284	1.75E-13	1.52E-10
ENSMUSGC Glis3	-4.04171	0.00053	0.01657
ENSMUSGC S100a1	-4.03351	2.65E-14	3.16E-11
ENSMUSGC Gm38299	-4.0092	0.001743	0.040622
ENSMUSGC Prrx1	-4.00401	3.82E-05	0.00201
ENSMUSGC Srgn	-4.00108	0.001011	0.02766
ENSMUSGC Trp63	-3.99354	0.000107	0.004664
ENSMUSGC Slc9a3r1	-3.99276	7.18E-17	3.30E-13
ENSMUSGC Irf6	-3.98836	0.001972	0.044717
ENSMUSGC Trim30a	-3.98581	0.001212	0.031561
ENSMUSGC Ptpn6	-3.97344	3.91E-06	0.000294
ENSMUSGC Gm10687	-3.95508	0.002218	0.048776
ENSMUSGC Acta2	-3.95074	7.87E-07	7.64E-05
ENSMUSGC Fas	-3.94396	4.94E-05	0.002475
ENSMUSGC Tmem119	-3.94388	4.50E-06	0.000332
ENSMUSGC Cldn10	-3.93916	2.71E-12	1.56E-09
ENSMUSGC Slc25a18	-3.93652	3.35E-15	5.39E-12
ENSMUSGC Ogn	-3.92133	0.000624	0.018854
ENSMUSGC Acsf2	-3.90781	7.38E-06	0.000504
ENSMUSGC Galm	-3.89937	1.64E-05	0.000993
ENSMUSGC P2ry13	-3.89601	2.95E-05	0.001629

ENSMUSG(Rfx4	-3.89413	9.83E-10	2.46E-07
ENSMUSG(mt-Tt	-3.88846	0.000878	0.024851
ENSMUSG(Sparc	-3.87811	2.23E-12	1.38E-09
ENSMUSG(Mlc1	-3.8759	4.94E-10	1.41E-07
ENSMUSG(C1qc	-3.86934	3.68E-12	2.07E-09
ENSMUSG(C1qa	-3.86136	1.04E-12	7.28E-10
ENSMUSG(Gm9347	-3.8533	5.29E-08	7.95E-06
ENSMUSG(Gstt3	-3.85296	1.49E-05	0.000912
ENSMUSG(mt-Th	-3.84885	4.52E-06	0.000333
ENSMUSG(Apoe	-3.84371	3.01E-15	5.36E-12
ENSMUSG(Gm16499	-3.84082	0.001899	0.043445
ENSMUSG(Mdk	-3.8296	1.83E-08	3.21E-06
ENSMUSG(Bgn	-3.82395	0.000262	0.009616
ENSMUSG(Casq2	-3.79815	0.000405	0.013505
ENSMUSG(Epas1	-3.79405	2.04E-09	4.64E-07
ENSMUSG(Heph	-3.78933	0.000119	0.005127
ENSMUSG(Aldh1l1	-3.78707	3.79E-12	2.10E-09
ENSMUSG(Sox10	-3.78371	9.27E-19	9.93E-15
ENSMUSG(Itgam	-3.77543	0.000274	0.009949
ENSMUSG(S100a6	-3.77161	2.43E-05	0.001389
ENSMUSG(C1qtnf5	-3.76951	4.70E-05	0.002371
ENSMUSG(Havcr2	-3.76583	0.000121	0.005196
ENSMUSG(Spin4	-3.76181	0.000609	0.018454
ENSMUSG(Apod	-3.76074	2.21E-14	2.73E-11
ENSMUSG(Prob1	-3.76051	0.000241	0.008993
ENSMUSG(Dio2	-3.75655	2.21E-07	2.66E-05
ENSMUSG(Zfp820	-3.75478	0.002209	0.048687
ENSMUSG(Ankub1	-3.74811	0.001743	0.040622
ENSMUSG(Tns3	-3.74749	1.20E-07	1.60E-05
ENSMUSG(Ppp1r3g	-3.74298	0.000226	0.008553
ENSMUSG(Phyh1	-3.7426	4.57E-07	4.87E-05
ENSMUSG(Ppp1r14a	-3.7416	1.32E-11	5.96E-09
ENSMUSG(Plcb3	-3.74093	1.43E-10	4.83E-08
ENSMUSG(Cdk5rap2	-3.73537	8.28E-11	2.99E-08
ENSMUSG(Csrp1	-3.72886	2.24E-19	3.60E-15
ENSMUSG(Klk6	-3.72392	1.12E-09	2.74E-07
ENSMUSG(mt-Rnr2	-3.72289	1.80E-10	5.80E-08
ENSMUSG(Foxb1	-3.71745	0.000282	0.010218
ENSMUSG(Klrg2	-3.71114	4.25E-05	0.002187
ENSMUSG(Slc14a1	-3.70992	2.28E-12	1.38E-09
ENSMUSG(Msx2	-3.70765	0.000701	0.020855
ENSMUSG(Lad1	-3.69041	0.001475	0.036243
ENSMUSG(Olfml3	-3.69022	2.46E-08	4.11E-06
ENSMUSG(Acsm5	-3.6895	0.001391	0.034848
ENSMUSG(Olig1	-3.68944	6.50E-18	4.18E-14
ENSMUSG(Gm4524	-3.68519	0.000216	0.008287
ENSMUSG(mt-Tl2	-3.68501	4.14E-05	0.002145

ENSMUSG(Myo1f	-3.67704	0.001006	0.027552
ENSMUSG(Dock5	-3.67131	0.001107	0.02956
ENSMUSG(mt-Nd3	-3.65552	7.36E-11	2.78E-08
ENSMUSG(Col1a2	-3.64275	2.50E-05	0.001424
ENSMUSG(Gng12	-3.63843	3.06E-14	3.30E-11
ENSMUSG(Tor4a	-3.63543	0.002034	0.045519
ENSMUSG(Aldh1a1	-3.63427	3.00E-14	3.30E-11
ENSMUSG(Dbx2	-3.62724	3.92E-12	2.10E-09
ENSMUSG(Satb2	-3.62123	0.001069	0.028783
ENSMUSG(mt-Tl1	-3.61242	7.74E-09	1.53E-06
ENSMUSG(Car2	-3.61075	9.79E-18	5.24E-14
ENSMUSG(Gstk1	-3.60182	1.18E-06	0.000105
ENSMUSG(Etnppl	-3.59231	3.79E-11	1.58E-08
ENSMUSG(Pycard	-3.59054	4.45E-05	0.002273
ENSMUSG(Qprt	-3.57754	0.001222	0.031711
ENSMUSG(Laptm5	-3.57439	1.57E-10	5.16E-08
ENSMUSG(Tek	-3.57081	0.000337	0.011711
ENSMUSG(mt-Ti	-3.56327	1.28E-06	0.000112
ENSMUSG(Cd74	-3.55965	3.40E-05	0.001838
ENSMUSG(Fblim1	-3.55334	0.001353	0.034119
ENSMUSG(Pdlim4	-3.55227	4.50E-06	0.000332
ENSMUSG(Hsd11b1	-3.55048	5.31E-05	0.002634
ENSMUSG(Atp1a2	-3.5476	1.04E-12	7.28E-10
ENSMUSG(AC167565.	-3.54589	0.000293	0.010541
ENSMUSG(Sdc4	-3.5429	1.35E-12	8.69E-10
ENSMUSG(Gas2l3	-3.53988	0.000619	0.018714
ENSMUSG(Slc6a11	-3.53367	6.08E-12	3.05E-09
ENSMUSG(Art3	-3.53191	6.76E-05	0.003204
ENSMUSG(Samd9l	-3.52374	0.000324	0.011376
ENSMUSG(Litaf	-3.52345	3.70E-16	1.19E-12
ENSMUSG(E130114P1	-3.52084	1.41E-06	0.000122
ENSMUSG(Gpr17	-3.52048	0.000298	0.010644
ENSMUSG(Kcnj10	-3.51706	1.80E-10	5.80E-08
ENSMUSG(Oaf	-3.51622	0.000458	0.014896
ENSMUSG(Mpeg1	-3.51579	0.000209	0.008054
ENSMUSG(Serpinb1a	-3.50633	2.06E-13	1.69E-10
ENSMUSG(BC064078	-3.50544	0.001871	0.043031
ENSMUSG(Gsdmd	-3.50533	0.000449	0.014647
ENSMUSG(Bbox1	-3.50303	9.96E-12	4.78E-09
ENSMUSG(Scrg1	-3.50077	3.21E-07	3.66E-05
ENSMUSG(Ly86	-3.49386	5.19E-06	0.000376
ENSMUSG(Xdh	-3.48567	0.000206	0.007986
ENSMUSG(2310022BC	-3.48544	1.05E-10	3.70E-08
ENSMUSG(Hist1h2bg	-3.48518	1.40E-07	1.84E-05
ENSMUSG(Gad1	-3.48197	3.38E-13	2.65E-10
ENSMUSG(Dock8	-3.46541	6.80E-05	0.003214
ENSMUSG(Pdk4	-3.46119	4.34E-06	0.000324

ENSMUSGC Slc1a3	-3.45684	2.39E-11	1.01E-08
ENSMUSGC Cd38	-3.45088	0.000438	0.014396
ENSMUSGC Gbp2	-3.44495	2.15E-05	0.001241
ENSMUSGC Ncf2	-3.44457	1.33E-05	0.000833
ENSMUSGC Gpr3711	-3.44308	7.96E-11	2.96E-08
ENSMUSGC Plekha2	-3.43277	2.18E-09	4.93E-07
ENSMUSGC 2900052NC	-3.43197	1.06E-08	2.01E-06
ENSMUSGC Npr3	-3.43124	0.000447	0.01461
ENSMUSGC Fa2h	-3.43	8.24E-10	2.15E-07
ENSMUSGC Xaf1	-3.42626	8.80E-06	0.000578
ENSMUSGC Cyp2j9	-3.4221	2.51E-09	5.61E-07
ENSMUSGC Lcat	-3.41777	1.63E-08	2.94E-06
ENSMUSGC Ermn	-3.41728	1.43E-15	2.90E-12
ENSMUSGC Dao	-3.40711	0.001223	0.031721
ENSMUSGC Acss1	-3.40434	8.51E-08	1.17E-05
ENSMUSGC Gfap	-3.40138	1.06E-12	7.28E-10
ENSMUSGC Ifi35	-3.40035	2.88E-05	0.001603
ENSMUSGC Ramp1	-3.39622	1.14E-10	3.94E-08
ENSMUSGC Ninj2	-3.39119	4.24E-05	0.002187
ENSMUSGC Bdh2	-3.3882	4.33E-07	4.66E-05
ENSMUSGC Rarres2	-3.38748	0.001757	0.040839
ENSMUSGC Inpp1	-3.38741	1.34E-09	3.22E-07
ENSMUSGC Slc25a34	-3.38648	9.43E-07	8.84E-05
ENSMUSGC Mgst1	-3.38601	1.12E-09	2.74E-07
ENSMUSGC Cyp2j12	-3.37985	6.45E-06	0.000452
ENSMUSGC Rftn2	-3.37663	9.03E-09	1.76E-06
ENSMUSGC Axl	-3.3729	2.03E-10	6.39E-08
ENSMUSGC Arhgap45	-3.36944	0.000512	0.016104
ENSMUSGC Irf8	-3.36879	0.000359	0.012316
ENSMUSGC Pla2g16	-3.36867	3.94E-14	4.08E-11
ENSMUSGC Tyrobp	-3.36648	0.000205	0.007986
ENSMUSGC Gm28438	-3.35249	5.10E-08	7.81E-06
ENSMUSGC Rbm12b1	-3.3443	3.62E-05	0.001936
ENSMUSGC Plekhf1	-3.34286	7.55E-10	1.99E-07
ENSMUSGC A930017K1	-3.34049	0.000488	0.015561
ENSMUSGC Olfr287	-3.32926	7.72E-06	0.000521
ENSMUSGC A330076CC	-3.31542	0.000899	0.025193
ENSMUSGC Pxn	-3.31535	3.48E-08	5.62E-06
ENSMUSGC Pcp2	-3.30621	3.44E-07	3.89E-05
ENSMUSGC Agt	-3.30479	3.35E-09	7.17E-07
ENSMUSGC Fgfr3	-3.29733	6.82E-16	1.83E-12
ENSMUSGC Pax3	-3.29383	0.00036	0.012321
ENSMUSGC Efhd1	-3.29158	8.88E-08	1.21E-05
ENSMUSGC Sox8	-3.29034	1.02E-11	4.80E-09
ENSMUSGC mt-Nd4l	-3.28833	9.78E-10	2.46E-07
ENSMUSGC Cyp4v3	-3.28395	1.40E-05	0.000868
ENSMUSGC Cldn11	-3.28116	1.53E-06	0.000132

ENSMUSG(Slc38a3	-3.27977	2.19E-07	2.64E-05
ENSMUSG(Lef1	-3.27819	0.000976	0.026843
ENSMUSG(Selpg	-3.27411	5.68E-11	2.25E-08
ENSMUSG(Heyl	-3.2741	3.62E-10	1.07E-07
ENSMUSG(Trim34a	-3.27323	0.001109	0.029588
ENSMUSG(Selenop	-3.2728	1.04E-12	7.28E-10
ENSMUSG(Lhx5	-3.27133	2.03E-06	0.000166
ENSMUSG(Lhx1os	-3.2692	7.15E-07	7.01E-05
ENSMUSG(Il33	-3.26606	1.85E-13	1.56E-10
ENSMUSG(Suclg2	-3.26578	3.93E-08	6.22E-06
ENSMUSG(Wipf1	-3.26217	3.71E-07	4.11E-05
ENSMUSG(Fmo1	-3.2604	6.90E-08	9.85E-06
ENSMUSG(Mylk	-3.25355	8.15E-06	0.000543
ENSMUSG(Mal	-3.24094	5.64E-12	2.88E-09
ENSMUSG(Epb41l2	-3.23759	6.25E-05	0.003038
ENSMUSG(Timp4	-3.23283	6.42E-08	9.21E-06
ENSMUSG(Plp1	-3.23229	9.14E-09	1.77E-06
ENSMUSG(Trim56	-3.23218	0.000378	0.012854
ENSMUSG(Dapp1	-3.22606	0.000283	0.010227
ENSMUSG(Wwtr1	-3.2151	0.000321	0.011296
ENSMUSG(Slc7a10	-3.21359	1.98E-07	2.46E-05
ENSMUSG(Sox5	-3.20862	7.60E-09	1.52E-06
ENSMUSG(Agmo	-3.2065	0.000241	0.008976
ENSMUSG(Htra3	-3.20258	0.000265	0.009695
ENSMUSG(BC026585	-3.19932	2.50E-08	4.15E-06
ENSMUSG(Nid1	-3.19859	0.000433	0.014284
ENSMUSG(Gpd1	-3.1931	1.06E-11	4.95E-09
ENSMUSG(Folh1	-3.18633	1.47E-07	1.88E-05
ENSMUSG(Wnt7a	-3.18532	0.00024	0.008976
ENSMUSG(Ctdsp2	-3.18419	1.24E-08	2.30E-06
ENSMUSG(Copz2	-3.18076	1.48E-06	0.000128
ENSMUSG(Igfbp2	-3.17607	0.000125	0.00533
ENSMUSG(Hist1h2be	-3.17536	1.45E-05	0.000891
ENSMUSG(Opalin	-3.17339	3.08E-09	6.63E-07
ENSMUSG(Entpd1	-3.17122	0.001428	0.035436
ENSMUSG(Rgs5	-3.16887	0.000188	0.007448
ENSMUSG(Clic1	-3.16353	5.99E-07	5.99E-05
ENSMUSG(Paqr6	-3.15851	2.60E-07	3.08E-05
ENSMUSG(Lhx1	-3.15815	0.001324	0.033617
ENSMUSG(Ndrgr2	-3.15318	9.10E-12	4.43E-09
ENSMUSG(Vcam1	-3.14585	4.80E-11	1.93E-08
ENSMUSG(Hpgds	-3.14496	1.42E-05	0.000871
ENSMUSG(Hepacam	-3.13986	1.13E-11	5.18E-09
ENSMUSG(Ifitm3	-3.13217	0.000234	0.008796
ENSMUSG(Zfp385c	-3.12855	0.00146	0.035975
ENSMUSG(Csf1r	-3.11744	4.81E-07	5.10E-05
ENSMUSG(Aqp4	-3.11544	1.65E-14	2.21E-11

ENSMUSG(Gpt	-3.11455	5.21E-09	1.08E-06
ENSMUSG(Aldh3b1	-3.10808	1.24E-05	0.000781
ENSMUSG(Gjb2	-3.1056	7.78E-06	0.000524
ENSMUSG(Tmem63a	-3.10553	3.14E-06	0.000244
ENSMUSG(Tgfb1	-3.10408	0.00167	0.039558
ENSMUSG(Myl9	-3.09825	1.01E-07	1.37E-05
ENSMUSG(Pax6	-3.09798	9.09E-05	0.004096
ENSMUSG(Tmbim1	-3.09714	1.06E-10	3.72E-08
ENSMUSG(Slc7a7	-3.09317	0.001043	0.028328
ENSMUSG(Bfsp2	-3.09145	2.25E-06	0.000182
ENSMUSG(Gja1	-3.08944	1.36E-09	3.23E-07
ENSMUSG(C030029HC	-3.08337	0.001995	0.044918
ENSMUSG(Ucp3	-3.07302	1.90E-05	0.001122
ENSMUSG(mt-Tq	-3.0726	0.000484	0.015473
ENSMUSG(Rgl3	-3.07258	0.000934	0.025896
ENSMUSG(Sparcl1	-3.0657	8.01E-11	2.96E-08
ENSMUSG(Sardh	-3.06529	0.001049	0.028415
ENSMUSG(Vsir	-3.06477	5.10E-05	0.002545
ENSMUSG(2700046AC	-3.05735	0.001857	0.042775
ENSMUSG(S100b	-3.05698	1.79E-12	1.12E-09
ENSMUSG(Pls1	-3.05258	1.02E-08	1.95E-06
ENSMUSG(Adamtsl4	-3.05149	0.000838	0.024087
ENSMUSG(Sult1a1	-3.0492	9.18E-07	8.65E-05
ENSMUSG(Nkx2-2	-3.04712	0.000295	0.010568
ENSMUSG(mt-Rnr1	-3.04636	8.36E-08	1.16E-05
ENSMUSG(Aspa	-3.04605	9.98E-11	3.56E-08
ENSMUSG(Irak3	-3.04145	0.001402	0.035029
ENSMUSG(Egfr	-3.04071	0.001271	0.0326
ENSMUSG(Plekho2	-3.0321	1.10E-08	2.07E-06
ENSMUSG(Spag5	-3.03205	6.78E-06	0.000472
ENSMUSG(Plekhh1	-3.02872	6.60E-05	0.003155
ENSMUSG(Sfrp5	-3.02127	4.96E-07	5.20E-05
ENSMUSG(Ezh2	-3.01953	6.66E-05	0.003171
ENSMUSG(Tifa	-3.0159	1.05E-06	9.61E-05
ENSMUSG(S1pr1	-3.01465	4.22E-11	1.72E-08
ENSMUSG(Ctsh	-3.01046	5.28E-06	0.000382
ENSMUSG(Sox9	-3.01034	1.44E-09	3.41E-07
ENSMUSG(Kcnj16	-3.00866	6.39E-10	1.71E-07
ENSMUSG(Rell1	-3.004	0.000776	0.02258
ENSMUSG(Cyba	-3.00355	2.12E-05	0.001229
ENSMUSG(Carhsp1	-3.00197	4.78E-10	1.37E-07
ENSMUSG(Id3	-3.00101	8.57E-10	2.20E-07
ENSMUSG(Cideb	-2.99609	0.002186	0.048314
ENSMUSG(Tnfrsf1a	-2.99608	4.07E-05	0.002116
ENSMUSG(Abca1	-2.9923	4.94E-07	5.19E-05
ENSMUSG(Slc1a2	-2.98986	2.67E-09	5.87E-07
ENSMUSG(Hhip	-2.98825	0.000266	0.009739

ENSMUSG(S100a16	-2.98739	3.93E-10	1.15E-07
ENSMUSG(Mfge8	-2.98346	3.88E-07	4.27E-05
ENSMUSG(Ddit4l	-2.97469	0.002006	0.045075
ENSMUSG(Dock1	-2.97114	5.89E-08	8.64E-06
ENSMUSG(Ii17ra	-2.97085	0.000137	0.00579
ENSMUSG(Gm40578	-2.94781	0.000214	0.00822
ENSMUSG(Pdgfra	-2.94623	0.001233	0.031889
ENSMUSG(Lgi4	-2.94159	2.50E-06	0.0002
ENSMUSG(Itih5	-2.93626	3.04E-08	4.93E-06
ENSMUSG(Arhgef10	-2.93579	6.81E-09	1.38E-06
ENSMUSG(Itih3	-2.9306	1.31E-07	1.74E-05
ENSMUSG(Calca	-2.93045	6.02E-08	8.75E-06
ENSMUSG(Slc30a3	-2.92849	8.13E-08	1.13E-05
ENSMUSG(Dennd4c	-2.92663	0.000924	0.025713
ENSMUSG(Itgb4	-2.92619	0.002104	0.046798
ENSMUSG(Gm10222	-2.92514	2.11E-07	2.57E-05
ENSMUSG(Sfxn5	-2.92138	9.87E-10	2.46E-07
ENSMUSG(Fcgrt	-2.92084	8.04E-08	1.12E-05
ENSMUSG(Ccdc190	-2.92074	0.002044	0.045651
ENSMUSG(Gatsl3	-2.91787	1.34E-05	0.000834
ENSMUSG(Slc39a12	-2.91388	1.17E-09	2.84E-07
ENSMUSG(Hadh	-2.91336	5.29E-12	2.74E-09
ENSMUSG(Acvrl1	-2.91058	0.001274	0.0326
ENSMUSG(Dmp1	-2.90913	0.001665	0.039447
ENSMUSG(Htra1	-2.90392	1.03E-06	9.45E-05
ENSMUSG(Cyp4f14	-2.90199	9.72E-06	0.000631
ENSMUSG(Plekhg3	-2.89968	9.55E-09	1.84E-06
ENSMUSG(Phkg1	-2.89683	7.27E-08	1.03E-05
ENSMUSG(Mro	-2.89643	8.67E-07	8.27E-05
ENSMUSG(Tmem100	-2.89611	3.65E-09	7.77E-07
ENSMUSG(Cmtm5	-2.88284	5.25E-10	1.46E-07
ENSMUSG(Elovl7	-2.88234	1.13E-07	1.51E-05
ENSMUSG(Mog	-2.87907	3.57E-08	5.74E-06
ENSMUSG(Lyn	-2.87701	0.00201	0.045147
ENSMUSG(Pygm	-2.87596	0.000355	0.012194
ENSMUSG(Amt	-2.87509	0.000169	0.006843
ENSMUSG(Anln	-2.87248	4.75E-10	1.37E-07
ENSMUSG(Magt1	-2.87105	1.16E-06	0.000103
ENSMUSG(Mboat1	-2.87059	0.00193	0.043989
ENSMUSG(mt-Tm	-2.86575	0.000802	0.023166
ENSMUSG(Hist1h1c	-2.8646	1.30E-07	1.73E-05
ENSMUSG(Rlbp1	-2.86445	1.37E-05	0.000852
ENSMUSG(Vtn	-2.86255	4.91E-07	5.19E-05
ENSMUSG(Gpsm2	-2.85224	0.000521	0.016301
ENSMUSG(Gm10644	-2.84985	0.001643	0.039235
ENSMUSG(Homer3	-2.84911	8.78E-07	8.32E-05
ENSMUSG(Igsf11	-2.84847	0.000227	0.008595

ENSMUSG(Cx3cr1	-2.8481	0.000428	0.014152
ENSMUSG(Prss35	-2.84767	0.000206	0.007986
ENSMUSG(Colec12	-2.84349	0.002266	0.049444
ENSMUSG(Snap23	-2.84145	1.17E-05	0.000744
ENSMUSG(Padi2	-2.83873	5.15E-10	1.45E-07
ENSMUSG(Ppp1r1b	-2.83446	1.47E-11	6.38E-09
ENSMUSG(Gstm2-ps1	-2.83279	5.28E-10	1.46E-07
ENSMUSG(Gng11	-2.82817	6.40E-09	1.32E-06
ENSMUSG(Naprt	-2.82593	0.000114	0.004927
ENSMUSG(Pctp	-2.82581	8.71E-06	0.000574
ENSMUSG(Gm14204	-2.82549	8.04E-05	0.00368
ENSMUSG(Cp	-2.817	0.001909	0.043604
ENSMUSG(Tmem51	-2.81649	0.00171	0.040136
ENSMUSG(A2m	-2.81597	0.000165	0.00671
ENSMUSG(Gstm1	-2.81291	2.48E-12	1.45E-09
ENSMUSG(Rbp1	-2.81251	0.000172	0.006942
ENSMUSG(Lmcd1	-2.81174	3.02E-07	3.49E-05
ENSMUSG(Ttyh2	-2.81118	6.22E-07	6.19E-05
ENSMUSG(Slc17a7	-2.80961	6.05E-06	0.000429
ENSMUSG(Gm8834	-2.80838	3.47E-05	0.001869
ENSMUSG(Prkd3	-2.80835	6.13E-07	6.12E-05
ENSMUSG(Slc6a5	-2.80513	9.12E-05	0.004105
ENSMUSG(Rhog	-2.80473	1.48E-09	3.48E-07
ENSMUSG(Tnfaip6	-2.80262	3.23E-07	3.67E-05
ENSMUSG(Cpt1a	-2.79996	2.43E-06	0.000195
ENSMUSG(Gm5637	-2.79653	0.001783	0.041304
ENSMUSG(Tmem98	-2.79634	5.34E-07	5.49E-05
ENSMUSG(Ddx58	-2.79622	0.00025	0.009265
ENSMUSG(Metrn	-2.79152	2.31E-08	3.93E-06
ENSMUSG(Glul	-2.78463	7.07E-12	3.50E-09
ENSMUSG(Gjc3	-2.77526	1.06E-06	9.61E-05
ENSMUSG(mt-Atp6	-2.77224	2.96E-06	0.000232
ENSMUSG(Serpinh1	-2.76269	0.000862	0.02457
ENSMUSG(Cpne3	-2.76247	6.45E-07	6.40E-05
ENSMUSG(Caskin2	-2.75847	5.24E-07	5.39E-05
ENSMUSG(Qk	-2.75308	1.40E-11	6.18E-09
ENSMUSG(Cd9	-2.74972	1.32E-07	1.74E-05
ENSMUSG(P2ry12	-2.74944	3.13E-06	0.000244
ENSMUSG(Scd1	-2.74831	3.79E-09	7.97E-07
ENSMUSG(Tcn2	-2.74759	3.13E-05	0.001711
ENSMUSG(Mfsd2a	-2.74666	1.36E-06	0.000118
ENSMUSG(Acot11	-2.74472	5.14E-08	7.82E-06
ENSMUSG(Nrarp	-2.73948	3.91E-07	4.27E-05
ENSMUSG(Nkx2-9	-2.73943	0.00045	0.01468
ENSMUSG(Clic4	-2.73778	1.96E-10	6.24E-08
ENSMUSG(Myoc	-2.73313	2.68E-05	0.001507
ENSMUSG(Cyfip1	-2.73157	3.08E-07	3.53E-05

ENSMUSGC Acadl	-2.73051	1.60E-09	3.72E-07
ENSMUSGC Ptgds	-2.72838	2.70E-06	0.000214
ENSMUSGC Col9a3	-2.7273	4.48E-05	0.002281
ENSMUSGC Myrf	-2.72379	2.44E-06	0.000195
ENSMUSGC Daam2	-2.71915	5.89E-06	0.000421
ENSMUSGC Bmp7	-2.71873	0.000285	0.010274
ENSMUSGC Nde1	-2.71358	1.09E-08	2.07E-06
ENSMUSGC Cbs	-2.71323	3.11E-10	9.33E-08
ENSMUSGC Arhgef19	-2.71164	2.90E-07	3.39E-05
ENSMUSGC Vamp8	-2.71148	0.000112	0.004864
ENSMUSGC Pla2g7	-2.71068	3.78E-09	7.97E-07
ENSMUSGC Cnp	-2.6954	2.46E-09	5.53E-07
ENSMUSGC Kif13b	-2.69528	4.25E-08	6.69E-06
ENSMUSGC Plce1	-2.69459	1.85E-06	0.000155
ENSMUSGC Sall1	-2.69352	2.90E-05	0.001606
ENSMUSGC Serping1	-2.68575	9.31E-06	0.000608
ENSMUSGC Tmem88b	-2.6857	7.53E-09	1.51E-06
ENSMUSGC Phactr4	-2.6822	0.00116	0.03058
ENSMUSGC Gjb6	-2.67571	1.90E-08	3.30E-06
ENSMUSGC Olfml1	-2.67397	2.21E-05	0.001265
ENSMUSGC Cyp2d22	-2.6667	2.95E-07	3.44E-05
ENSMUSGC Etv4	-2.66667	0.000112	0.004871
ENSMUSGC Pgghg	-2.66533	0.000109	0.004759
ENSMUSGC Gjc2	-2.66456	6.39E-06	0.000449
ENSMUSGC Cryab	-2.65751	4.18E-11	1.72E-08
ENSMUSGC Capg	-2.65333	0.000153	0.006322
ENSMUSGC Trf	-2.65274	1.18E-06	0.000105
ENSMUSGC Zfp36l2	-2.65022	6.40E-05	0.003085
ENSMUSGC Tlcd1	-2.64693	6.04E-06	0.000429
ENSMUSGC Pxmp2	-2.64434	7.52E-05	0.003494
ENSMUSGC Tspan15	-2.64427	2.24E-06	0.000182
ENSMUSGC Cfh	-2.64251	0.001058	0.028583
ENSMUSGC Gatm	-2.63582	8.11E-11	2.96E-08
ENSMUSGC Stard13	-2.63568	3.40E-06	0.000258
ENSMUSGC Efemp1	-2.63169	3.09E-05	0.001693
ENSMUSGC Apln	-2.62914	8.50E-07	8.15E-05
ENSMUSGC Skor1	-2.62905	0.000599	0.018231
ENSMUSGC Eva1a	-2.62627	1.43E-07	1.87E-05
ENSMUSGC Cyp26b1	-2.6188	0.000337	0.011711
ENSMUSGC Gm15163	-2.61644	5.70E-05	0.002804
ENSMUSGC Car8	-2.61296	1.54E-10	5.10E-08
ENSMUSGC Cdc42ep1	-2.60886	1.89E-07	2.37E-05
ENSMUSGC Slc15a2	-2.59346	1.41E-05	0.000869
ENSMUSGC Trim25	-2.59086	4.81E-05	0.002419
ENSMUSGC Abhd3	-2.59013	2.60E-09	5.77E-07
ENSMUSGC C4b	-2.58859	1.77E-06	0.000149
ENSMUSGC Selenbp1	-2.58706	2.11E-07	2.57E-05

ENSMUSG(Nkx6-2	-2.58669	1.72E-08	3.09E-06
ENSMUSG(Dnaic1	-2.58479	0.00058	0.017748
ENSMUSG(Ssfa2	-2.58459	3.69E-07	4.10E-05
ENSMUSG(Kat2b	-2.57887	9.84E-07	9.11E-05
ENSMUSG(Pbxip1	-2.57438	1.44E-10	4.83E-08
ENSMUSG(Zc3hav1	-2.57306	2.51E-06	0.0002
ENSMUSG(Trem2	-2.57238	6.38E-05	0.003084
ENSMUSG(Nfia	-2.56818	5.09E-07	5.28E-05
ENSMUSG(Plpp3	-2.56745	3.73E-07	4.12E-05
ENSMUSG(Sgk1	-2.56377	1.74E-09	4.00E-07
ENSMUSG(Plip	-2.56177	3.16E-06	0.000245
ENSMUSG(Prkd1	-2.56075	0.000234	0.008796
ENSMUSG(Eya1	-2.55961	5.66E-06	0.000407
ENSMUSG(Gm42756	-2.55406	0.000689	0.020543
ENSMUSG(Rab31	-2.55343	1.17E-10	4.00E-08
ENSMUSG(Tnfaip8	-2.55094	2.08E-05	0.001208
ENSMUSG(Sash1	-2.55083	5.44E-07	5.55E-05
ENSMUSG(Inpp5d	-2.54966	0.000676	0.020223
ENSMUSG(Lamb2	-2.54924	1.99E-06	0.000164
ENSMUSG(Lpcat2	-2.54889	1.08E-06	9.73E-05
ENSMUSG(Lims2	-2.54882	8.75E-07	8.32E-05
ENSMUSG(Eps8l2	-2.54399	0.000109	0.004765
ENSMUSG(Npepl1	-2.54273	6.74E-05	0.003201
ENSMUSG(Ppp1r3c	-2.54192	1.57E-07	1.99E-05
ENSMUSG(Ctsc	-2.54103	4.84E-05	0.002426
ENSMUSG(Abhd4	-2.54062	1.81E-07	2.28E-05
ENSMUSG(Lrig1	-2.53701	4.31E-08	6.76E-06
ENSMUSG(Nfix	-2.53495	2.43E-07	2.89E-05
ENSMUSG(Arhgap31	-2.53469	2.02E-06	0.000166
ENSMUSG(Mt2	-2.53462	9.07E-06	0.000594
ENSMUSG(Tmc6	-2.5324	0.000713	0.021067
ENSMUSG(Zfp36l1	-2.53181	6.51E-05	0.003124
ENSMUSG(Lhfp	-2.53024	2.72E-05	0.001527
ENSMUSG(Rbl1	-2.5239	0.001418	0.035331
ENSMUSG(Sapcd2	-2.52342	0.000726	0.021354
ENSMUSG(Cnn3	-2.52319	6.25E-10	1.69E-07
ENSMUSG(AI464131	-2.52283	2.13E-05	0.00123
ENSMUSG(Dab2	-2.52084	5.44E-05	0.002683
ENSMUSG(Gltp	-2.51701	1.30E-08	2.38E-06
ENSMUSG(Jph1	-2.51681	2.07E-05	0.001208
ENSMUSG(Insc	-2.51608	3.80E-05	0.002004
ENSMUSG(Akna	-2.50754	0.001165	0.030644
ENSMUSG(Wfdc1	-2.50537	0.000841	0.024129
ENSMUSG(Ccdc122	-2.50319	0.000559	0.01726
ENSMUSG(Boc	-2.50224	0.001786	0.041344
ENSMUSG(Elovl1	-2.50197	0.0002	0.007854
ENSMUSG(Gm28035	-2.4934	0.00076	0.022186

ENSMUSG(C Timp3	-2.49206	1.33E-06	0.000116
ENSMUSG(C Mpst	-2.49049	3.40E-05	0.001838
ENSMUSG(C Pnpla7	-2.48966	6.87E-06	0.000476
ENSMUSG(C Rgma	-2.48955	0.00143	0.035466
ENSMUSG(C Cd82	-2.48649	5.55E-07	5.62E-05
ENSMUSG(C Gab1	-2.48408	1.07E-06	9.70E-05
ENSMUSG(C Mertk	-2.48339	4.03E-05	0.0021
ENSMUSG(C Myo6	-2.48181	2.73E-08	4.47E-06
ENSMUSG(C Evi2a	-2.47724	5.38E-05	0.002659
ENSMUSG(C Thbs2	-2.47338	0.001584	0.038154
ENSMUSG(C Glns-ps1	-2.47047	0.000172	0.006925
ENSMUSG(C Tril	-2.46677	4.86E-08	7.54E-06
ENSMUSG(C Prr5l	-2.4644	2.10E-07	2.57E-05
ENSMUSG(C F3	-2.46093	1.45E-07	1.87E-05
ENSMUSG(C Dcn	-2.45675	9.77E-05	0.004311
ENSMUSG(C Fxyd1	-2.45425	7.28E-05	0.003409
ENSMUSG(C Rasgrp3	-2.45211	0.001021	0.02784
ENSMUSG(C Sorbs3	-2.44915	5.80E-08	8.55E-06
ENSMUSG(C Mitf	-2.44739	0.000302	0.010766
ENSMUSG(C Rcsd1	-2.44275	0.000121	0.005196
ENSMUSG(C D7Ert443i	-2.43869	0.000692	0.020636
ENSMUSG(C A230001M	-2.43817	0.000365	0.012442
ENSMUSG(C Tmem125	-2.43683	1.89E-06	0.000158
ENSMUSG(C Arhgef26	-2.43471	1.67E-06	0.000142
ENSMUSG(C Mag	-2.43226	1.49E-05	0.000912
ENSMUSG(C Dcx	-2.4281	2.58E-05	0.001456
ENSMUSG(C Acap2	-2.42696	2.21E-05	0.001265
ENSMUSG(C Arpc1b	-2.42347	0.000327	0.011462
ENSMUSG(C Bmpr1b	-2.42059	6.13E-05	0.002992
ENSMUSG(C Myo1d	-2.41973	3.72E-06	0.000281
ENSMUSG(C Mical1	-2.41623	0.000245	0.009119
ENSMUSG(C Gad2	-2.41146	1.70E-09	3.93E-07
ENSMUSG(C Ugt8a	-2.41138	4.25E-05	0.002187
ENSMUSG(C Sgk2	-2.41082	0.000442	0.014483
ENSMUSG(C Vstm4	-2.41057	2.75E-05	0.001535
ENSMUSG(C Rn7s2	-2.40807	0.000285	0.010274
ENSMUSG(C Gpr34	-2.407	0.000184	0.007335
ENSMUSG(C Igsf1	-2.40578	7.02E-06	0.000484
ENSMUSG(C Gm26694	-2.40223	0.000116	0.00499
ENSMUSG(C Nemp2	-2.40134	0.00229	0.049854
ENSMUSG(C Sod3	-2.39907	4.07E-05	0.002116
ENSMUSG(C Tjp2	-2.39886	1.33E-06	0.000116
ENSMUSG(C Slco1c1	-2.39827	0.000182	0.007291
ENSMUSG(C Cldn14	-2.39734	0.000531	0.016585
ENSMUSG(C Cyth4	-2.39705	1.58E-05	0.000959
ENSMUSG(C Igfbp7	-2.39524	0.000165	0.00671
ENSMUSG(C Tmod1	-2.39502	1.89E-05	0.001116

ENSMUSGC Anxa3	-2.39359	8.47E-05	0.003861
ENSMUSGC Ednrb	-2.38874	1.12E-07	1.51E-05
ENSMUSGC Scara3	-2.38536	0.001067	0.028756
ENSMUSGC Zfyve21	-2.38263	1.83E-07	2.30E-05
ENSMUSGC Emp2	-2.38103	4.78E-06	0.00035
ENSMUSGC Tnni1	-2.37856	0.000234	0.008796
ENSMUSGC Mt1	-2.37587	7.00E-08	9.96E-06
ENSMUSGC Elf1	-2.37474	0.000546	0.016959
ENSMUSGC Sox6	-2.37077	0.000629	0.018992
ENSMUSGC Zfyve16	-2.37019	0.000213	0.008207
ENSMUSGC Zbtb16	-2.36574	0.000205	0.007986
ENSMUSGC Nts	-2.36526	2.40E-06	0.000194
ENSMUSGC Pltp	-2.36516	4.33E-07	4.66E-05
ENSMUSGC Cyp27a1	-2.36167	0.001578	0.038088
ENSMUSGC Hist2h2be	-2.36045	0.000395	0.013296
ENSMUSGC H2-K1	-2.35721	9.39E-05	0.004199
ENSMUSGC Nwd1	-2.35667	7.63E-05	0.003529
ENSMUSGC Hspb1	-2.35593	0.00058	0.017748
ENSMUSGC Map2	-2.35508	1.20E-06	0.000106
ENSMUSGC Pla2g4a	-2.35463	0.000221	0.008429
ENSMUSGC Sec14l2	-2.35421	2.42E-06	0.000195
ENSMUSGC AW047730	-2.35137	1.39E-05	0.000865
ENSMUSGC Triobp	-2.346	0.000268	0.009763
ENSMUSGC Sox1ot	-2.3429	0.00081	0.023358
ENSMUSGC Slc6a20a	-2.33085	0.001955	0.044424
ENSMUSGC Afap1l2	-2.32643	1.76E-05	0.001056
ENSMUSGC Ntsr2	-2.32612	1.96E-08	3.39E-06
ENSMUSGC Gjb1	-2.31919	4.47E-06	0.000332
ENSMUSGC Cav1	-2.31872	5.84E-05	0.002866
ENSMUSGC Slc12a4	-2.31496	6.90E-05	0.003252
ENSMUSGC Mmp14	-2.3147	4.54E-05	0.00231
ENSMUSGC Reep3	-2.30012	2.52E-05	0.001427
ENSMUSGC Islr	-2.29703	0.002234	0.048968
ENSMUSGC Ldlrap1	-2.29669	0.000661	0.019848
ENSMUSGC Stxbp3	-2.28975	4.51E-07	4.83E-05
ENSMUSGC Prox1	-2.28885	0.000207	0.007995
ENSMUSGC Nfe2l3	-2.28869	0.001493	0.036476
ENSMUSGC Neu4	-2.28689	3.55E-05	0.0019
ENSMUSGC Itgb8	-2.28674	2.10E-07	2.57E-05
ENSMUSGC Enpp2	-2.28566	8.61E-05	0.003905
ENSMUSGC Rin2	-2.27789	5.74E-07	5.78E-05
ENSMUSGC Dhrs4	-2.2766	3.28E-05	0.001791
ENSMUSGC Ltbr	-2.27458	0.000258	0.009519
ENSMUSGC Prrg1	-2.27456	1.06E-05	0.000679
ENSMUSGC Stxbp3-ps	-2.27385	9.48E-05	0.004218
ENSMUSGC mt-Nd5	-2.27354	2.96E-06	0.000232
ENSMUSGC Jam2	-2.27305	3.46E-07	3.90E-05

ENSMUSG(Notch2	-2.27292	0.000918	0.025559
ENSMUSG(Gm28439	-2.27279	4.27E-06	0.00032
ENSMUSG(Mcc	-2.27152	3.36E-06	0.000255
ENSMUSG(mt-Nd2	-2.27047	6.88E-06	0.000476
ENSMUSG(Rasl11a	-2.26787	0.000903	0.025287
ENSMUSG(Zfp36	-2.26008	0.001391	0.034848
ENSMUSG(Plxnb3	-2.25863	6.65E-05	0.003171
ENSMUSG(Trp53bp2	-2.25772	7.74E-05	0.003564
ENSMUSG(Pde1c	-2.25735	0.000976	0.026843
ENSMUSG(Glipr2	-2.2557	0.001655	0.039337
ENSMUSG(Nkain4	-2.25209	1.28E-06	0.000112
ENSMUSG(Prex1	-2.25176	5.63E-08	8.34E-06
ENSMUSG(Slc6a9	-2.25166	8.42E-07	8.11E-05
ENSMUSG(Ctso	-2.24753	0.000414	0.013758
ENSMUSG(Gstm7	-2.24613	5.10E-08	7.81E-06
ENSMUSG(Gm973	-2.24445	1.51E-05	0.00092
ENSMUSG(Mmd2	-2.23672	8.92E-09	1.75E-06
ENSMUSG(Cyp2j6	-2.23501	0.000311	0.011042
ENSMUSG(Ifit3	-2.23423	1.32E-05	0.000827
ENSMUSG(Tmc7	-2.2339	0.000167	0.006773
ENSMUSG(Icosl	-2.23292	0.001086	0.029216
ENSMUSG(Id1	-2.22849	0.000349	0.012053
ENSMUSG(Fbxo32	-2.22405	0.001308	0.033253
ENSMUSG(Mtrmr10	-2.2217	2.84E-05	0.001581
ENSMUSG(Ptpn13	-2.22066	0.001037	0.028238
ENSMUSG(Lpp	-2.22043	0.001241	0.031994
ENSMUSG(Gbp7	-2.21988	0.002207	0.048667
ENSMUSG(Phldb1	-2.21795	2.48E-07	2.94E-05
ENSMUSG(Gpm6b	-2.21701	2.51E-08	4.16E-06
ENSMUSG(Gm45767	-2.21442	9.45E-05	0.004212
ENSMUSG(Tsc22d4	-2.21159	6.16E-08	8.92E-06
ENSMUSG(Wls	-2.21145	0.000402	0.013453
ENSMUSG(mt-Nd4	-2.21069	1.91E-05	0.001126
ENSMUSG(mt-Nd1	-2.20287	5.18E-05	0.002582
ENSMUSG(Sspn	-2.19549	0.000117	0.005046
ENSMUSG(Rn7s1	-2.19384	0.000225	0.00854
ENSMUSG(Hip1	-2.18253	1.80E-05	0.001077
ENSMUSG(Prex2	-2.17503	2.44E-05	0.001389
ENSMUSG(Gm9791	-2.1749	0.001095	0.029389
ENSMUSG(Pm20d1	-2.16986	0.000323	0.011366
ENSMUSG(Mbp	-2.16879	1.58E-05	0.000961
ENSMUSG(Unc93b1	-2.16566	5.04E-05	0.00252
ENSMUSG(Gm2a	-2.1591	2.17E-08	3.71E-06
ENSMUSG(Lmx1a	-2.15875	9.71E-07	9.07E-05
ENSMUSG(Mob3b	-2.15837	3.36E-05	0.001823
ENSMUSG(Gm2115	-2.15632	7.57E-05	0.003505
ENSMUSG(Bcan	-2.1556	3.97E-07	4.31E-05

ENSMUSGC Cpq	-2.1538	3.29E-06	0.000252
ENSMUSGC Entpd2	-2.15288	0.000254	0.009394
ENSMUSGC Sugct	-2.14569	3.71E-05	0.001973
ENSMUSGC Gramd3	-2.14376	6.44E-05	0.003096
ENSMUSGC Serinc5	-2.14148	1.87E-05	0.001108
ENSMUSGC Frmd8	-2.13891	1.00E-07	1.37E-05
ENSMUSGC Gpr37	-2.13599	0.000188	0.007448
ENSMUSGC Inf2	-2.13349	0.000499	0.015825
ENSMUSGC Kansl1l	-2.13326	0.000783	0.022773
ENSMUSGC Myo9b	-2.13095	9.66E-05	0.004278
ENSMUSGC Lrig3	-2.12932	0.001781	0.041304
ENSMUSGC Rassf2	-2.12331	1.01E-06	9.26E-05
ENSMUSGC Ly6a	-2.12213	0.001704	0.040136
ENSMUSGC mt-Nd6	-2.12064	4.20E-05	0.002168
ENSMUSGC Oplah	-2.11967	3.35E-05	0.001822
ENSMUSGC Susd5	-2.11802	0.000513	0.016127
ENSMUSGC Tfp2b	-2.11252	3.33E-06	0.000253
ENSMUSGC Tjp1	-2.1087	1.92E-05	0.001126
ENSMUSGC Tac1	-2.09784	1.31E-05	0.000825
ENSMUSGC Mdc1	-2.09621	0.000445	0.014571
ENSMUSGC Lactb2	-2.09599	2.91E-05	0.001606
ENSMUSGC Rorb	-2.09415	5.37E-07	5.50E-05
ENSMUSGC Abcd2	-2.09158	2.17E-06	0.000177
ENSMUSGC Rnf135	-2.08324	0.001111	0.0296
ENSMUSGC Rhoc	-2.07828	0.001783	0.041304
ENSMUSGC Anxa4	-2.07754	0.000362	0.012386
ENSMUSGC Fryl	-2.0767	0.000319	0.011261
ENSMUSGC Chil1	-2.07627	1.77E-05	0.001061
ENSMUSGC Creb5	-2.07234	0.001409	0.035132
ENSMUSGC mt-Atp8	-2.07109	0.000463	0.015007
ENSMUSGC Trim59	-2.06265	1.87E-05	0.001107
ENSMUSGC Cnn2	-2.05847	0.000221	0.008422
ENSMUSGC Arhgdib	-2.05061	0.00014	0.005886
ENSMUSGC Fermt2	-2.04229	3.53E-07	3.96E-05
ENSMUSGC mt-Cytb	-2.04052	0.000154	0.006372
ENSMUSGC Gpt2	-2.03673	1.66E-06	0.000142
ENSMUSGC Csnk1g1	-2.03017	0.001371	0.034505
ENSMUSGC Acaa2	-2.02819	9.37E-06	0.00061
ENSMUSGC D16Ert47	-2.02775	0.000436	0.014334
ENSMUSGC Ttyh1	-2.02475	5.55E-08	8.26E-06
ENSMUSGC Slc7a2	-2.02414	0.000461	0.014967
ENSMUSGC St18	-2.02244	0.000127	0.005397
ENSMUSGC Irak2	-2.01924	3.07E-06	0.00024
ENSMUSGC Sh3bgr	-2.01834	0.000425	0.014074
ENSMUSGC Fam53b	-2.01425	3.39E-05	0.001838
ENSMUSGC Smtnl2	-2.01268	0.000225	0.00854
ENSMUSGC Gm10925	-2.01209	0.000155	0.006389

ENSMUSG(C Ddo	-2.00459	8.27E-06	0.000549
ENSMUSG(C Gm35040	-2.00175	0.001707	0.040136
ENSMUSG(C Gpr146	-2.0002	0.000121	0.005173
ENSMUSG(C Cdr1	-1.99861	1.10E-06	9.90E-05
ENSMUSG(C Rhpn2	-1.99463	1.01E-05	0.000652
ENSMUSG(C Ino80d	-1.98951	0.00071	0.021042
ENSMUSG(C Myo10	-1.98932	5.36E-05	0.002652
ENSMUSG(C Ppp1r18	-1.98597	0.000668	0.020027
ENSMUSG(C Aldh6a1	-1.98148	1.08E-06	9.73E-05
ENSMUSG(C Paqr8	-1.98008	2.72E-05	0.001528
ENSMUSG(C Cmtm6	-1.97941	9.53E-05	0.004228
ENSMUSG(C Appl2	-1.97883	9.83E-07	9.11E-05
ENSMUSG(C Hsd3b7	-1.97679	0.000279	0.010103
ENSMUSG(C Zeb1	-1.97504	7.97E-05	0.003655
ENSMUSG(C Bcas1	-1.96609	0.00048	0.015381
ENSMUSG(C Trps1	-1.96434	0.000372	0.012684
ENSMUSG(C Hes5	-1.96214	4.32E-05	0.002212
ENSMUSG(C Ss18	-1.96149	2.67E-05	0.001507
ENSMUSG(C Serhl	-1.9595	0.000554	0.017138
ENSMUSG(C Stk17b	-1.95939	0.000491	0.015612
ENSMUSG(C Mobp	-1.95913	3.89E-05	0.002034
ENSMUSG(C Emilin2	-1.9537	0.001951	0.044396
ENSMUSG(C Gna13	-1.94586	3.73E-05	0.001973
ENSMUSG(C Gpam	-1.94438	1.09E-05	0.000698
ENSMUSG(C Nfib	-1.93753	0.000155	0.006395
ENSMUSG(C Aldoc	-1.93134	2.05E-07	2.53E-05
ENSMUSG(C Apc	-1.93086	2.00E-06	0.000165
ENSMUSG(C Sft2d2	-1.93048	9.18E-05	0.004119
ENSMUSG(C Slc12a2	-1.92772	0.000114	0.004927
ENSMUSG(C Dpyd	-1.92738	9.13E-05	0.004105
ENSMUSG(C Exoc3l4	-1.92681	0.000161	0.006542
ENSMUSG(C Arhgap17	-1.92566	0.000328	0.011479
ENSMUSG(C Il1rap	-1.92006	0.001054	0.028499
ENSMUSG(C Tmem229a	-1.91544	1.52E-06	0.000131
ENSMUSG(C Ifi27	-1.91461	1.95E-06	0.000162
ENSMUSG(C Snhg14	-1.91168	0.001148	0.030445
ENSMUSG(C Tnpo1	-1.90835	3.26E-06	0.00025
ENSMUSG(C Fads2	-1.9073	4.84E-05	0.002426
ENSMUSG(C Dbi	-1.90362	1.14E-05	0.000723
ENSMUSG(C Tspan14	-1.90263	0.000346	0.011973
ENSMUSG(C Psat1	-1.90097	2.12E-07	2.57E-05
ENSMUSG(C Myo1b	-1.89921	0.001114	0.029647
ENSMUSG(C Acad11	-1.89714	5.28E-05	0.002625
ENSMUSG(C St6galnac3	-1.89434	0.001687	0.039884
ENSMUSG(C Prelp	-1.88776	7.41E-05	0.003455
ENSMUSG(C Fgfr2	-1.88737	0.000263	0.009642
ENSMUSG(C Serpine2	-1.88612	1.30E-05	0.000817

ENSMUSGC Slc25a13	-1.88443	0.000329	0.011479
ENSMUSGC Npas3	-1.88434	3.71E-05	0.001973
ENSMUSGC Skap2	-1.88236	8.27E-06	0.000549
ENSMUSGC Itgav	-1.88166	0.001089	0.029273
ENSMUSGC Lpcat3	-1.88086	0.000719	0.021228
ENSMUSGC Gpld1	-1.87788	0.00029	0.010429
ENSMUSGC Abtb2	-1.87612	0.000104	0.004571
ENSMUSGC Fads1	-1.87557	2.90E-05	0.001606
ENSMUSGC Slc13a3	-1.87271	0.000473	0.015245
ENSMUSGC Mvp	-1.87078	3.72E-05	0.001973
ENSMUSGC Scd2	-1.8698	7.91E-05	0.003633
ENSMUSGC Gm28437	-1.86905	0.00057	0.017488
ENSMUSGC Spg11	-1.86694	0.000143	0.00597
ENSMUSGC Fam163a	-1.86693	0.001156	0.030514
ENSMUSGC mt-Co3	-1.86622	0.000702	0.020855
ENSMUSGC Hmox1	-1.86558	0.000389	0.013141
ENSMUSGC Fam181b	-1.86	7.65E-06	0.000517
ENSMUSGC Spsb1	-1.85791	0.000188	0.007448
ENSMUSGC Mboat2	-1.84462	5.73E-06	0.00041
ENSMUSGC Fbxo30	-1.83727	0.000452	0.014703
ENSMUSGC Zeb2	-1.83636	0.000842	0.024137
ENSMUSGC Gm28661	-1.82733	0.001278	0.032668
ENSMUSGC Pacsin3	-1.8247	3.80E-05	0.002004
ENSMUSGC Elovl2	-1.82437	0.001268	0.032557
ENSMUSGC Tanc1	-1.81822	6.14E-05	0.002992
ENSMUSGC Necap2	-1.81779	1.60E-05	0.00097
ENSMUSGC Arap2	-1.7968	0.000604	0.018353
ENSMUSGC Tgfa	-1.79617	3.89E-05	0.002033
ENSMUSGC mt-Co2	-1.78964	0.001394	0.034878
ENSMUSGC 4930402H2	-1.78776	1.55E-05	0.000942
ENSMUSGC Plekhh1	-1.7872	0.000178	0.007159
ENSMUSGC Phka1	-1.7845	0.000156	0.006396
ENSMUSGC Lrrc1	-1.783	0.000631	0.019035
ENSMUSGC 2-Sep	-1.78107	2.60E-06	0.000206
ENSMUSGC Hr	-1.77898	0.000724	0.021311
ENSMUSGC Fmo5	-1.77791	0.001833	0.042248
ENSMUSGC Crhbp	-1.77701	0.000533	0.016614
ENSMUSGC Trp53bp1	-1.77644	0.000213	0.008195
ENSMUSGC mt-Co1	-1.77558	0.001194	0.031172
ENSMUSGC Id2	-1.77442	4.52E-06	0.000333
ENSMUSGC Syne1	-1.76518	1.95E-05	0.001145
ENSMUSGC Llgl1	-1.7627	8.06E-06	0.000541
ENSMUSGC Cxcl14	-1.76069	5.91E-05	0.002897
ENSMUSGC Sqor	-1.76011	0.000184	0.007335
ENSMUSGC Prdx6	-1.75966	7.56E-06	0.000514
ENSMUSGC Cdk19	-1.75142	0.001208	0.031487
ENSMUSGC Rest	-1.74844	0.001403	0.035032

ENSMUSGC	4-Sep	-1.74122	9.32E-07	8.75E-05
ENSMUSGC	Nfat5	-1.73337	0.000469	0.015146
ENSMUSGC	Prkcq	-1.72801	0.000295	0.010568
ENSMUSGC	Rida	-1.72441	4.58E-05	0.002323
ENSMUSGC	Cald1	-1.71777	0.000709	0.021015
ENSMUSGC	Cavin1	-1.71471	0.001522	0.036916
ENSMUSGC	Mettl7a1	-1.71459	0.000396	0.013303
ENSMUSGC	Abhd5	-1.7108	0.000221	0.008422
ENSMUSGC	Cep97	-1.70279	0.000499	0.015828
ENSMUSGC	Peli2	-1.69452	0.000331	0.011534
ENSMUSGC	Il18	-1.69404	0.00019	0.007515
ENSMUSGC	Spata13	-1.69008	0.001881	0.04321
ENSMUSGC	2810468NC	-1.67917	7.35E-05	0.003438
ENSMUSGC	Nek9	-1.67092	0.000195	0.007679
ENSMUSGC	Fam234a	-1.66335	0.000267	0.009757
ENSMUSGC	Fut10	-1.66047	0.002088	0.046501
ENSMUSGC	Usp53	-1.65664	0.00027	0.009827
ENSMUSGC	Fah	-1.65066	2.91E-05	0.001606
ENSMUSGC	Smpd3a	-1.64953	0.001873	0.043065
ENSMUSGC	Tns1	-1.64832	8.62E-05	0.003905
ENSMUSGC	Msn	-1.64691	0.001152	0.030514
ENSMUSGC	Carmil1	-1.64587	0.000147	0.006107
ENSMUSGC	Dmd	-1.64397	0.000272	0.009882
ENSMUSGC	Slc27a1	-1.6302	0.000186	0.007397
ENSMUSGC	Tpmt	-1.62933	0.000934	0.025896
ENSMUSGC	Hacl1	-1.62728	0.001697	0.040042
ENSMUSGC	Ppfibp2	-1.62059	0.001824	0.042138
ENSMUSGC	Yes1	-1.61638	0.001206	0.031445
ENSMUSGC	Snx22	-1.61319	0.000552	0.017117
ENSMUSGC	Klf3	-1.60857	0.00051	0.016081
ENSMUSGC	Vamp3	-1.60125	0.000377	0.012833
ENSMUSGC	Phlpp1	-1.5998	8.61E-05	0.003905
ENSMUSGC	Kdm3b	-1.59643	0.00048	0.015381
ENSMUSGC	Add3	-1.59226	2.18E-05	0.001253
ENSMUSGC	Neat1	-1.59022	0.000939	0.026024
ENSMUSGC	Nbeal1	-1.58895	0.00066	0.019848
ENSMUSGC	Pir	-1.58627	0.001044	0.028328
ENSMUSGC	Maob	-1.58562	3.84E-05	0.002015
ENSMUSGC	Fkbp9	-1.58474	0.002224	0.048847
ENSMUSGC	Plekhd1	-1.58036	0.000883	0.024922
ENSMUSGC	Klf15	-1.5782	6.97E-05	0.003277
ENSMUSGC	Sbf2	-1.57742	0.000199	0.007816
ENSMUSGC	Etv5	-1.5625	0.000232	0.008759
ENSMUSGC	Acsl6	-1.56173	0.000206	0.007986
ENSMUSGC	Eci1	-1.55667	0.000433	0.014284
ENSMUSGC	Ccnd3	-1.55472	0.000544	0.016929
ENSMUSGC	Kctd5	-1.53958	0.00014	0.005886

ENSMUSGC Ctnnd1	-1.53906	0.000547	0.016987
ENSMUSGC Cat	-1.53286	4.80E-05	0.002419
ENSMUSGC Ndrgr1	-1.53231	2.52E-05	0.001427
ENSMUSGC Kmt2c	-1.52988	0.002004	0.045071
ENSMUSGC Ankhd1	-1.52629	0.000396	0.013303
ENSMUSGC Plcd4	-1.52499	0.002049	0.045726
ENSMUSGC Lims1	-1.51847	0.000877	0.024851
ENSMUSGC Nup160	-1.51511	0.001981	0.0448
ENSMUSGC Trim36	-1.50997	0.000762	0.022215
ENSMUSGC Hacd2	-1.50793	0.000787	0.022821
ENSMUSGC Asrgl1	-1.50534	0.000257	0.009505
ENSMUSGC Ccnd1	-1.49758	0.001161	0.03058
ENSMUSGC Wnk1	-1.49475	0.00035	0.012068
ENSMUSGC Thrsp	-1.48916	0.001518	0.036916
ENSMUSGC Nr3c2	-1.48847	0.001482	0.03633
ENSMUSGC Ephx2	-1.48775	0.001007	0.027552
ENSMUSGC Dnm2	-1.48546	9.07E-05	0.004094
ENSMUSGC Esr1	-1.48367	0.001186	0.031059
ENSMUSGC Zcchc24	-1.48109	0.000205	0.007986
ENSMUSGC Wasf2	-1.47372	0.002166	0.047964
ENSMUSGC Sec14l1	-1.46735	0.000424	0.014053
ENSMUSGC Birc6	-1.46246	0.000287	0.010347
ENSMUSGC Pcca	-1.46141	0.00137	0.034505
ENSMUSGC Golgb1	-1.45854	0.002242	0.049108
ENSMUSGC Tcf12	-1.45703	0.000562	0.017302
ENSMUSGC Mob1a	-1.44404	0.002265	0.049444
ENSMUSGC Lap3	-1.43988	0.000239	0.008963
ENSMUSGC B2m	-1.43826	0.000472	0.015228
ENSMUSGC Nufip2	-1.435	0.000749	0.021952
ENSMUSGC Ankrd52	-1.42635	0.001693	0.039976
ENSMUSGC Mcur1	-1.42559	0.000979	0.02689
ENSMUSGC Smg1	-1.42432	0.001334	0.033815
ENSMUSGC Abl1	-1.42176	0.001953	0.044418
ENSMUSGC Igfbp4	-1.42035	0.001658	0.039368
ENSMUSGC Gabpa	-1.41672	0.00222	0.048804
ENSMUSGC Crot	-1.41392	0.000483	0.015433
ENSMUSGC Otud7b	-1.41365	0.000326	0.011433
ENSMUSGC Ivd	-1.41287	0.000662	0.019853
ENSMUSGC Kihl4	-1.41254	0.001631	0.039082
ENSMUSGC Tcf4	-1.41207	0.000619	0.018714
ENSMUSGC Htt	-1.41166	0.000789	0.02286
ENSMUSGC Dbndd2	-1.41071	0.000554	0.017138
ENSMUSGC Luzp2	-1.40829	0.00036	0.012332
ENSMUSGC Hexb	-1.40389	0.001163	0.030604
ENSMUSGC C130021I2I	-1.40012	0.001274	0.0326
ENSMUSGC Cplx2	-1.39123	0.000241	0.008976
ENSMUSGC Pex5l	-1.39055	0.000724	0.021311

ENSMUSG(Ptch1	-1.38995	0.001155	0.030514
ENSMUSG(Zyx	-1.38553	0.001284	0.032721
ENSMUSG(Pnpla2	-1.38542	0.000476	0.015301
ENSMUSG(Hipk2	-1.38316	0.000507	0.016029
ENSMUSG(Vwa8	-1.37813	0.001626	0.039022
ENSMUSG(Kmt2d	-1.3754	0.000463	0.015
ENSMUSG(Tmcc3	-1.37391	0.000516	0.016184
ENSMUSG(Pcx	-1.37292	0.000871	0.024738
ENSMUSG(Agl	-1.36713	0.001093	0.029367
ENSMUSG(Aldh4a1	-1.35059	0.001216	0.031617
ENSMUSG(Gm13910	-1.33801	0.000785	0.0228
ENSMUSG(Nacc2	-1.3339	0.000433	0.014284
ENSMUSG(Chm	-1.33127	0.001479	0.036288
ENSMUSG(Znfx1	-1.3277	0.001587	0.038198
ENSMUSG(Dip2a	-1.32055	0.002265	0.049444
ENSMUSG(Hsd17b4	-1.31816	0.00075	0.021952
ENSMUSG(Cpped1	-1.31036	0.000907	0.025313
ENSMUSG(Hadha	-1.30279	0.000683	0.0204
ENSMUSG(Ppp1r16b	-1.29506	0.000569	0.017482
ENSMUSG(Ipo7	-1.29299	0.001407	0.035106
ENSMUSG(Limch1	-1.27815	0.001054	0.028499
ENSMUSG(Pik3r1	-1.26723	0.001758	0.040839
ENSMUSG(Rora	-1.26328	0.000853	0.024333
ENSMUSG(Pnn	-1.25372	0.00158	0.038125
ENSMUSG(Dazap2	-1.24899	0.001189	0.0311
ENSMUSG(Nacad	-1.24881	0.000886	0.024922
ENSMUSG(Anxa5	-1.22807	0.000561	0.017297
ENSMUSG(Ak3	-1.21985	0.001982	0.0448
ENSMUSG(Washc2	-1.21324	0.001108	0.029563
ENSMUSG(Hcfc1	-1.21195	0.001214	0.031593
ENSMUSG(Scp2	-1.20475	0.001713	0.040146
ENSMUSG(Tmem47	-1.19935	0.001281	0.0327
ENSMUSG(Nr3c1	-1.19452	0.001672	0.039571
ENSMUSG(Capn2	-1.1902	0.001499	0.036598
ENSMUSG(Adk	-1.18818	0.001796	0.041551
ENSMUSG(Eps15	-1.18777	0.001522	0.036916
ENSMUSG(Hook3	-1.18322	0.001919	0.043773
ENSMUSG(Dtna	-1.18206	0.002021	0.045258
ENSMUSG(Jup	-1.18194	0.001508	0.036777
ENSMUSG(Sirt2	-1.14947	0.001893	0.043398
ENSMUSG(Fnbp1	-1.14011	0.001987	0.044849

Supplementary Table 2. Summary of statistical analyses

Figure	Sample size (n)	Statistical test	P values
1i	Mice: 3 Brain slices: 20	Two-tailed unpaired t-test	$t=5.056$, $df=38$ $P<0.0001$
2e	Warming: 14 mice Cooling: 14 mice	Two-tailed paired t test	$t=3.398$, $df=13$, $P=0.0048$
2h	GCaMP6: 10 mice 21°C: 30 trials 16°C: 34 trials 10°C: 32 trials 4°C: 33 trials	Brown-Forsythe and Welch ANOVA tests Don't correct for multiple comparisons test	F^* (DFn , DFd) 0.4612 (3.000, 122.7), $P=0.7099$ Multiple comparisons: 21°C vs. 16°C, $P=0.4077$ 21°C vs. 10°C, $P=0.3677$ 21°C vs. 4°C, $P=0.2756$ 16°C vs. 10°C, $P=0.9587$ 16°C vs. 4°C, $P=0.7521$ 10°C vs. 4°C, $P=0.7838$
2i	GCaMP6: 10 mice 21°C: 30 trials 16°C: 34 trials 10°C: 32 trials 4°C: 33 trials	Brown-Forsythe and Welch ANOVA tests Don't correct for multiple comparisons test	F^* (DFn , DFd) 17.70 (3.000, 116.8), $P<0.0001$ Multiple comparisons: 21°C vs. 16°C, $P=0.2288$ 21°C vs. 10°C, $P<0.0001$ 21°C vs. 4°C, $P<0.0001$ 16°C vs. 10°C, $P=0.0021$ 16°C vs. 4°C, $P<0.0001$ 10°C vs. 4°C, $P=0.0547$
2k	GCaMP6: 10 mice 35-20°C: 20 trials 32-17°C: 17 trials 25-10°C: 26 trials 29-14°C: 17 trials	Brown-Forsythe and Welch ANOVA tests Don't correct for multiple comparisons test	F^* (DFn , DFd) 0.1478 (3.000, 66.04), $P=0.9308$ Multiple comparisons: 35-20°C vs. 32-17°C, $P=0.6186$ 35-20°C vs. 25-10°C, $P=0.4975$ 35-20°C vs. 29-14°C, $P=0.9098$ 32-17°C vs. 25-10°C, $P=0.8965$ 32-17°C vs. 29-14°C, $P=0.7182$ 25-10°C vs. 29-14°C, $P=0.6058$
2l	GCaMP6: 10 mice 35-20°C: 20 trials 32-17°C: 17 trials 25-10°C: 26 trials 29-14°C: 17 trials	Brown-Forsythe and Welch ANOVA tests Don't correct for multiple comparisons test	F^* (DFn , DFd) 25.48 (3.000, 103.9), $P=0.1478$ Multiple comparisons: 35-20°C vs. 32-17°C, $P=0.0484$ 35-20°C vs. 25-10°C, $P<0.0001$ 35-20°C vs. 29-14°C, $P<0.0001$ 32-17°C vs. 25-10°C, $P<0.0001$ 32-17°C vs. 29-14°C, $P=0.0084$ 25-10°C vs. 29-14°C, $P=0.0033$
2n	GCaMP6: 10 mice 0.1°C/s: 19 trials 0.2°C/s: 20 trials 0.4°C/s: 20 trials 0.7°C/s: 20 trials	Brown-Forsythe and Welch ANOVA tests Don't correct for multiple comparisons test	F^* (DFn , DFd) 1.693 (3.000, 57.55), $P=0.1785$ Multiple comparisons: 0.1°C/s vs. 0.2°C/s, $P=0.0356$ 0.1°C/s vs. 0.4°C/s, $P=0.0696$ 0.1°C/s vs. 0.7°C/s, $P=0.0853$ 0.2°C/s vs. 0.4°C/s, $P=0.7986$ 0.2°C/s vs. 0.7°C/s, $P=0.4623$ 0.4°C/s vs. 0.7°C/s, $P=0.6562$
2o	GCaMP6: 10 mice 0.1°C/s: 19 trials 0.2°C/s: 20 trials 0.4°C/s: 20 trials 0.7°C/s: 20 trials	Brown-Forsythe and Welch ANOVA tests Don't correct for multiple comparisons test	F^* (DFn , DFd) 0.4130 (3.000, 71.93), $P=0.7442$ Multiple comparisons: 0.1°C/s vs. 0.2°C/s, $P=0.8573$ 0.1°C/s vs. 0.4°C/s, $P=0.3253$ 0.1°C/s vs. 0.7°C/s, $P=0.6648$ 0.2°C/s vs. 0.4°C/s, $P=0.4287$ 0.2°C/s vs. 0.7°C/s, $P=0.8226$ 0.4°C/s vs. 0.7°C/s, $P=0.5019$
2s	Warming: 6 mice Cooling: 6 mice	Two-tailed paired t test	$t=5.560$, $df=5$, $P=0.0026$
2t	Warming: 6 mice Cooling: 6 mice	Two-tailed paired t test	$t=4.319$, $df=5$, $P=0.0076$
3c	GFP: 10 mice DMH ^{only} projecting LPB TeNT: 9 mice	RM two-way ANOVA factor one: virus (GFP, DMH ^{only} projecting LPB TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 17) = 2.664$, $P=0.1210$ Time: $F(2.199, 37.38) = 5.516$, $P=0.0065$ Interaction: $F(360, 6120) = 2.338$, $P<0.0001$ Multiple comparisons: GFP vs. DMH ^{only} projecting LPB TeNT: 95 min – 108 min, $P<0.0493$ 117 min – 120 min, $P<0.0488$ 123 min – 130 min, $P<0.0495$
	DMH ^{only} projecting LPB TeNT: 9 mice POA ^{only} projecting LPB TeNT: 7mice	RM two-way ANOVA factor one: virus (DMH ^{only} projecting LPB TeNT, POA ^{only} projecting LPB TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 14) = 0.09332$, $P=0.7645$ Time: $F(2.201, 30.82) = 8.153$, $P=0.0011$ Interaction: $F(360, 5040) = 0.7286$, $P>0.9999$ Multiple comparisons: POA ^{only} projecting LPB TeNT vs. DMH ^{only} projecting LPB TeNT: $P>0.1575$
3d	GFP: 10 mice DMH ^{only} projecting LPB TeNT: 8 mice POA ^{only} projecting LPB TeNT: 7mice	RM two-way ANOVA factor one: virus (GFP, DMH ^{only} projecting LPB TeNT, POA ^{only} projecting LPB TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(2, 22) = 2.757$, $P=0.0854$ Time: $F(2.837, 62.40) = 14.82$, $P<0.0001$ Interaction: $F(720, 7920) = 1.745$, $P<0.0001$ Multiple comparisons: GFP vs. DMH ^{only} projecting LPB TeNT: 15 min – 74 min, $P<0.0466$ 220 min – 300 min, $P<0.0193$

(table continued on the next page)

Supplementary Table 2. Summary of statistical analyses

Figure	Sample size (n)	Statistical test	P values
3e	GFP: 10 mice DMH ^{only} projecting LPB TeNT: 8 mice	RM two-way ANOVA factor one: virus (GFP, DMH ^{only} projecting LPB TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 16) = 10.66, P=0.0049$ Time: $F(360, 5760) = 28.00, P<0.0001$ Interaction: $F(360, 5760) = 5.486, P<0.0001$ Multiple comparisons: GFP vs. DMH ^{only} projecting LPB TeNT: 19 min – 69 min, $P<0.0498$ 159 min – 300 min, $P<0.0098$
	DMH ^{only} projecting LPB TeNT: 8 mice POA ^{only} projecting LPB TeNT: 7mice	RM two-way ANOVA factor one: virus (DMH ^{only} projecting LPB TeNT, POA ^{only} projecting LPB TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 13) = 0.03077, P=0.8635$ Time: $F(360, 4680) = 36.17, P<0.0001$ Interaction: $F(360, 4680) = 0.4357, P>0.9999$ Multiple comparisons: DMH ^{only} projecting LPB TeNT vs. POA ^{only} projecting LPB TeNT: $P>0.1381$
3f	GFP: 10 mice DMH ^{only} projecting LPB TeNT: 8 mice	RM two-way ANOVA factor one: virus (GFP, DMH ^{only} projecting LPB TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 16) = 8.921, P=0.0087$ Time: $F(360, 5760) = 32.63, P<0.0001$ Interaction: $F(360, 5760) = 5.171, P<0.0001$ Multiple comparisons: GFP vs. DMH ^{only} projecting LPB TeNT: 57 min – 300 min, $P<0.0088$
	DMH ^{only} projecting LPB TeNT: 8 mice POA ^{only} projecting LPB TeNT: 7mice	RM two-way ANOVA factor one: virus (DMH ^{only} projecting LPB TeNT, POA ^{only} projecting LPB TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 13) = 2.382, P=0.1467$ Time: $F(360, 4680) = 47.96, P<0.0001$ Interaction: $F(360, 4680) = 1.279, P=0.0004$ Multiple comparisons: DMH ^{only} projecting LPB TeNT vs. POA ^{only} projecting LPB TeNT: 16 min – 62 min, $P<0.0483$
3h	GFP: 10 DMH ^{LPB} blocking: 10	RM two-way ANOVA factor one: virus (GFP, DMH ^{LPB} blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 18) = 29.88, P<0.0001$ Time: $F(4.518, 81.32) = 15.14, P<0.0001$ Interaction: $F(360, 4680) = 6.670, P<0.0001$ Multiple comparisons: 37 min – 300 min, $P<0.0075$
	POA ^{LPB} blocking: 9 Co-blocking: 6	RM two-way ANOVA factor one: virus (POA ^{LPB} blocking, Co-blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 13) = 3.875, P=0.0707$ Time: $F(2.126, 27.64) = 24.71, P<0.0001$ Interaction: $F(360, 4680) = 1.089, P=0.1264$ Multiple comparisons: 75 min – 149 min, $P<0.0487$
	POA ^{LPB} blocking: 9 DMH ^{LPB} blocking: 10	RM two-way ANOVA factor one: virus (POA ^{LPB} blocking, DMH ^{LPB} blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 17) = 0.9149, P=0.3522$ Time: $F(2.349, 39.93) = 27.73, P<0.0001$ Interaction: $F(360, 6120) = 1.761, P<0.0001$ Multiple comparisons: 35 min – 54 min, $P<0.0453$
3i	GFP: 10 DMH ^{LPB} blocking: 10	RM two-way ANOVA factor one: virus (GFP, DMH ^{LPB} blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 18) = 22.52, P=0.0002$ Time: $F(3.450, 62.11) = 37.24, P<0.0001$ Interaction: $F(360, 6480) = 11.66, P<0.0001$ Multiple comparisons: 7 min – 300 min, $P<0.0095$
	POA ^{LPB} blocking: 9 Co-blocking: 6	RM two-way ANOVA factor one: virus (POA ^{LPB} blocking, Co-blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 13) = 4.561, P=0.0523$ Time: $F(2.316, 30.10) = 53.89, P<0.0001$ Interaction: $F(360, 4680) = 6.098, P<0.0001$ Multiple comparisons: 116 min – 300 min, $P<0.0495$
	POA ^{LPB} blocking: 9 DMH ^{LPB} blocking: 10	RM two-way ANOVA factor one: virus (POA ^{LPB} blocking, DMH ^{LPB} blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 17) = 0.06235, P=0.8058$ Time: $F(2.683, 45.62) = 39.88, P<0.0001$ Interaction: $F(360, 6120) = 0.6782, P>0.9999$ Multiple comparisons: 19 min – 35 min, $P<0.0471$
3j	GFP: 10 DMH ^{LPB} blocking: 10	RM two-way ANOVA factor one: virus (GFP, DMH ^{LPB} blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 18) = 34.35, P<0.0001$ Time: $F(2.993, 53.87) = 106.5, P<0.0001$ Interaction: $F(360, 6480) = 25.91, P<0.0001$ Multiple comparisons: 31 min – 300 min, $P<0.0008$
	POA ^{LPB} blocking: 9 DMH ^{LPB} blocking: 10	RM two-way ANOVA factor one: virus (POA ^{LPB} blocking, DMH ^{LPB} blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 17) = 0.2659, P=0.6128$ Time: $F(2.421, 41.16) = 122.5, P<0.0001$ Interaction: $F(360, 6120) = 0.6928, P>0.9999$ Multiple comparisons: $P>0.2914$
	POA ^{LPB} blocking: 9 Co-blocking: 6	RM two-way ANOVA factor one: virus (POA ^{LPB} blocking, Co-blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 13) = 2.316, P=0.1520$ Time: $F(1.727, 22.45) = 137.5, P<0.0001$ Interaction: $F(154, 2002) = 3.619, P<0.0001$ Multiple comparisons: 61 min – 94 min, $P<0.0482$
3k	GFP: 10 DMH ^{LPB} blocking: 10	RM two-way ANOVA factor one: virus (GFP, DMH ^{LPB} blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 18) = 93.14, P<0.0001$ Time: $F(2.270, 40.86) = 158.3, P<0.0001$ Interaction: $F(277, 4986) = 46.53, P<0.0001$ Multiple comparisons: 31 min – 217 min, $P<0.0009$
	POA ^{LPB} blocking: 9 DMH ^{LPB} blocking: 10	RM two-way ANOVA factor one: virus (POA ^{LPB} blocking, DMH ^{LPB} blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 17) = 0.02254, P=0.8824$ Time: $F(277, 4709) = 192.6, P<0.0001$ Interaction: $F(277, 4709) = 1.468, P<0.0001$ Multiple comparisons: 22 min – 37 min, $P<0.0429$
	POA ^{LPB} blocking: 9 Co-blocking: 6	RM two-way ANOVA factor one: virus (POA ^{LPB} blocking, Co-blocking) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 13) = 5.089, P=0.0419$ Time: $F(1.814, 23.58) = 166.2, P<0.0001$ Interaction: $F(120, 1560) = 4.740, P<0.0001$ Multiple comparisons: 36 min – 59 min, $P<0.0417$

(table continued on the next page)

Supplementary Table 2. Summary of statistical analyses

Figure	Sample size (n)	Statistical test	P values
4c	ChR2: 10 mice GFP: 8 mice	RM two-way ANOVA factor one: virus (ChR2, GFP) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 16) = 11.26, P=0.0040$ Time: $F(90, 1440) = 7.309, P<0.0001$ Interaction: $F(90, 1440) = 12.99, P<0.0001$ Multiple comparisons: 8 min – 40 min, $P<0.0001$
4d	ChR2: 10 mice GFP: 8 mice	RM two-way ANOVA factor one: virus (ChR2, GFP) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 16) = 30.92, P<0.0001$ Time: $F(90, 1440) = 4.328, P<0.0001$ Interaction: $F(90, 1440) = 1.737, P<0.0001$ multiple comparisons: Before-After: 0 min – 38 min, $P<0.0396$
4k	Non-blocking: 10 mice DMH ^{Vglut2} blocking: 5 mice DMH ^{Vgat} blocking: 5 mice POA blocked: 5 mice	RM two-way ANOVA factor one: treatment (Non-blocking, DMH ^{Vglut2} blocking, DMH ^{Vgat} blocking, POA blocking) factor two: time Bonferroni's multiple comparisons test	Treatment: $F(3, 21) = 9.102, P=0.0005$ Time: $F(90, 1890) = 11.60, P<0.0001$ Interaction: $F(270, 1890) = 10.46, P<0.0001$ Multiple comparisons: Non-blocking vs. DMH ^{Vglut2} blocking: 9 min – 45 min, $P<0.0001$ Non-blocking vs. DMH ^{Vgat} blocking: 7 min – 43 min, $P<0.0001$ Non-blocking vs. POA blocking: $P>0.4970$
4l	Non-blocking: 10 mice DMH ^{Vglut2} blocking: 5 mice DMH ^{Vgat} blocking: 5 mice GFP: 5 mice	RM two-way ANOVA factor one: treatment (Non-blocking, DMH ^{Vglut2} blocking, DMH ^{Vgat} blocking, GFP) factor two: time Bonferroni's multiple comparisons test	Treatment: $F(3, 21) = 9.566, P=0.0003$ Time: $F(1, 21) = 13.59, P=0.0014$ Interaction: $F(3, 21) = 7.305, P=0.0015$ Multiple comparisons: b.s. vs. 10 min – 30 min: Non-blocking: $P=0.0005$ GFP: $P>0.9999$ DMH ^{Vglut2} blocking: $P=0.8948$ DMH ^{Vgat} blocking: $P>0.9999$
4m	5 mice each	RM two-way ANOVA factor one: treatment (Non-blocking, DMH ^{Vglut2} blocking, DMH ^{Vgat} blocking, GFP) factor two: time Bonferroni's multiple comparisons test	Treatment: $F(3, 16) = 23.36, P<0.0001$ Time: $F(9, 144) = 1.652, P=0.1060$ Interaction: $F(27, 144) = 8.832, P<0.0001$ Multiple comparisons: GFP vs. Non-blocking: 8 min – 60 min, $P<0.0002$ GFP vs. DMH ^{Vgat} blocking: 8 min – 30 min, $P<0.016$ GFP vs. DMH ^{Vglut2} blocking: $P>0.3106$
4n	4 mice each	RM two-way ANOVA factor one: treatment (Non-blocking, DMH ^{Vglut2} blocking, DMH ^{Vgat} blocking) factor two: time Bonferroni's multiple comparisons test	Treatment: $F(3, 12) = 26.85, P<0.0001$ Time: $F(12, 144) = 9.665, P<0.0001$ Interaction: $F(36, 144) = 9.762, P<0.0001$ Multiple comparisons: Non-blocking vs. DMH ^{Vglut2} blocking: 40 s – 60 s, $P<0.0001$ Non-blocking vs. DMH ^{Vgat} blocking: 40 s – 60 s, $P<0.0001$ Non-blocking vs. GFP: 40 – 60 s, $P<0.0001$
4o	5 mice each	RM two-way ANOVA factor one: treatment (Non-blocking, DMH ^{Vglut2} blocking, DMH ^{Vgat} blocking, GFP) factor two: time Bonferroni's multiple comparisons test	Treatment: $F(3, 16) = 3.472, P=0.0410$ Time: $F(90, 1440) = 1.897, P<0.0001$ Interaction: $F(270, 1440) = 2.218, P<0.0001$ Multiple comparisons: Non-blocking vs. GFP: 1 – 14 min, $P<0.01$ Non-blocking vs. DMH ^{Vglut2} blocking: 1 min – 16 min, $P<0.01$ Non-blocking vs. DMH ^{Vgat} blocking: 1 min – 27 min, $P<0.01$
4q	ChR2: 6mice	RM one-way ANOVA factor one: treatment (ChR2: 24°C, ChR2: 6°C, ChR2: 30°C,) Bonferroni's multiple comparisons test	Treatment: $F(2, 15) = 1.890, P=0.1854$ Multiple comparisons: 30 °C vs. 24 °C: $P=0.7829$ 24 °C vs. 6 °C: $P=0.7706$
4r	ChR2: 6mice	RM one-way ANOVA factor one: treatment (ChR2: 24°C, ChR2: 6°C, ChR2: 30°C,) Bonferroni's multiple comparisons test	Treatment: $F(2, 10) = 14.57, P=0.0011$ Multiple comparisons: 30 °C vs. 6 °C: $P=0.0012$ 24 °C vs. 6 °C: $P=0.0027$
5c	GFP: 9 mice ChR2: 9 mice	Two-tailed unpaired t test	$t=3.205, df=16, P=0.0055$
5g	ChR2: 9 mice GFP: 5 mice	RM two-way ANOVA factor one: virus (ChR2, GFP) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 12) = 1.604, P=0.2294$ Time: $F(33, 396) = 25.36, P<0.0001$ Interaction: $F(33, 396) = 1.439, P=0.0590$ Multiple comparisons: 10 -16 day, $P<0.0261$
5h	ChR2: 9 mice GFP: 5 mice	RM two-way ANOVA factor one: treatment (GFP, ChR2) factor two: time Bonferroni's multiple comparisons test	Treatment: $F(1, 168) = 32.50, P<0.0001$ Time: $F(13, 168) = 141.0, P<0.0001$ Interaction: $F(13, 168) = 0.6262, P=0.8299$ Multiple comparisons: $P>0.1307$
5i	GFP: 6 mice ChR2: 6 mice	Two-tailed unpaired t test	$t=3.348, df=10, P=0.0074$
5j	GFP: 6 mice ChR2: 6 mice	Two-tailed unpaired t test	$t=2.235, df=10, P=0.0494$
5k	ChR2: 6 mice GFP: 6 mice	Ordinary two-way ANOVA factor one: virus (ChR2, GFP) factor two: tissues (fat, lean) Bonferroni's multiple comparisons test	Virus: $F(1, 20) = 5.225, P=0.0333$ Tissues: $F(1, 20) = 130.0, P<0.0001$ Interaction: $F(1, 20) = 13.16, P=0.0017$ Multiple comparisons: Fat: ChR2 vs. GFP: $P=0.0009$ Lean: ChR2 vs. GFP: $P=0.7085$
5l	ChR2: 9 mice GFP: 5 mice	Ordinary two-way ANOVA factor one: virus (ChR2, GFP) factor two: time (-200-0, 0-400) Šidák's multiple comparisons test	Virus: $F(1, 12) = 4.963, P=0.0458$ Time: $F(1, 12) = 354.4, P<0.0001$ Interaction: $F(1, 12) = 4.062, P=0.0668$ Multiple comparisons: -200 min - 0 min: $P=0.5522$ 0 min - 400 min: $P=0.0149$

(table continued on the next page)

Supplementary Table 2. Summary of statistical analyses

Figure	Sample size (n)	Statistical test	P values
7c	Chr2: 8 mice GFP: 7 mice	RM two-way ANOVA factor one: virus (Chr2, GFP) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 13) = 8.669, P=0.0114$ Time: $F(90, 1170) = 10.24, P<0.0001$ Interaction: $F(90, 1170) = 8.463, P<0.0001$ Multiple comparisons: 14 min – 49 min: $P<0.0061$
7d	Chr2: 8 mice GFP: 7 mice	RM two-way ANOVA factor one: virus (Chr2, GFP) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 13) = 0.1853, P=0.1965$ Time: $F(90, 1170) = 1.020, P<0.4314$ Interaction: $F(90, 1170) = 0.8949, P=0.7459$ Multiple comparisons: $P>0.9999$
7e	Chr2: 6 mice GFP: 7 mice	RM two-way ANOVA factor one: virus (Chr2, GFP) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 11) = 31.63, P=0.0002$ Time: $F(18, 198) = 7.932, P<0.0001$ Interaction: $F(18, 198) = 7.532, P<0.0001$ Multiple comparisons: 5 min – 40 min: $P<0.0037$
7f	Sham: 6 mice Denervation: 6 mice	RM two-way ANOVA factor one: treatment (Sham, Denervation) factor two: time Bonferroni's multiple comparisons test	Treatment: $F(1, 10) = 3.611, P=0.0866$ Time: $F(89, 890) = 12.18, P<0.0001$ Interaction: $F(89, 890) = 5.664, P<0.0001$ Multiple comparisons: 22 min – 34 min: $P<0.0390$
7g	SST: 4 mice Vglut2: 4 mice	RM two-way ANOVA factor one: mice (SST, Vglut2) factor two: time Bonferroni's multiple comparisons test	Mice: $F(1, 6) = 259.6, P<0.0001$ Time: $F(12, 72) = 9.856, P<0.0001$ Interaction: $F(12, 72) = 8.922, P<0.0001$ Multiple comparisons: 40 s – 60 s, $P<0.0001$
7h	SST: 8 mice Vglut2: 5 mice	RM two-way ANOVA factor one: mice (SST, Vglut2) factor two: time Bonferroni's multiple comparisons test	Mice: $F(2, 15) = 1.564, P=0.2416$ Time: $F(89, 1335) = 1.907, P<0.0001$ Interaction: $F(178, 1335) = 2.628, P<0.0001$ Multiple comparisons: 0 min – 16 min, $P<0.0012$
7k	Chr2: 6 mice Chr2 + TeNT: 6 mice	RM two-way ANOVA factor one: virus (Chr2, Chr2 + TeNT) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 10) = 0.04145, P=0.8428$ Time: $F(2.483, 24.83) = 0.04145, P<0.0001$ Interaction: $F(18, 180) = 0.8825, P=6003$ Multiple comparisons: $P>0.9878$
7l	Chr2: 6 mice Chr2 + TeNT: 6 mice	RM two-way ANOVA factor one: virus (Chr2, Chr2 + TeNT) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 10) = 0.4483, P=0.5183$ Time: $F(4.334, 43.34) = 21.94, P<0.0001$ Interaction: $F(18, 180) = 3.162, P<0.0001$ Multiple comparisons: $P>0.9999$
7n	taCasp3: 8 mice mCherry: 8 mice	RM two-way ANOVA factor one: virus (taCasp3, mCherry) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 14) = 0.01322, P=0.7216$ Time: $F(60, 840) = 35.12, P<0.0001$ Interaction: $F(60, 840) = 0.5366, P=0.9985$ Multiple comparisons: $P>0.9999$
7o	taCasp3: 8 mice mCherry: 8 mice	RM two-way ANOVA factor one: virus (taCasp3, mCherry) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 14) = 12.95, P=0.0029$ Time: $F(60, 455) = 47.2, P<0.0001$ Interaction: $F(60, 775) = 12.17, P<0.0001$ Multiple comparisons: 180 min – 300 min, $P<0.0014$
7r	Non-blocking: 8 mice DMH ^{Lep&SST-TeNT} : 7 mice DMH ^{ChAT&SST-TeNT} : 7 mice	RM two-way ANOVA factor one: treatment (Non-blocking, DMH ^{Lep&SST-TeNT} , DMH ^{ChAT&SST-TeNT}) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 13) = 11.18, P=0.0053$ Time: $F(90, 1170) = 13.96, P<0.0001$ Interaction: $F(90, 1170) = 4.768, P<0.0001$ Multiple comparisons: Non-blocking vs. DMH ^{Lep&SST-TeNT} , 11 min – 51 min, $P<0.0381$

(table continued on the next page)

Supplementary Table 2. Summary of statistical analyses

Figure	Sample size (n)	Statistical test	P values
S5d	GFP: 7 mice DMH ^{LPB} blocking: 7 mice POA ^{LPB} blocking: 7 mice	Ordinary one-way ANOVA factor one: virus (GFP, DMH ^{LPB} blocking, POA ^{LPB} blocking) Tukey's multiple comparisons test	Treatment: $F(2, 3) = 0.4269, P=0.6868$ Multiple comparisons: DMH ^{LPB} blocking vs. POA ^{LPB} blocking: $P=0.6663$ GFP vs. POA ^{LPB} blocking: $P=0.9211$ DMH ^{LPB} blocking vs. GFP: $P=0.8634$
S5e	POA ^{LPB} -blocking: 7 mice DMH ^{LPB} -blocking: 7 mice GFP control: 7 mice	Ordinary one-way ANOVA factor: treatment (POA ^{LPB} -blocking, DMH ^{LPB} -blocking, GFP control) Tukey's multiple comparisons test	Dark: Treatment: $F(2, 18) = 12.89, P=0.0003$ Multiple comparisons: POA ^{LPB} blocking vs. DMH ^{LPB} blocking, $P=0.0008$ POA ^{LPB} blocking vs. GFP, $P=0.0012$ DMH ^{LPB} blocking vs. GFP, $P=0.9845$ Light: Treatment: $F(2, 18) = 11.33, P=0.0007$ Multiple comparisons: POA ^{LPB} blocking vs. DMH ^{LPB} blocking, $P=0.0385$ POA ^{LPB} blocking vs. GFP, $P=0.0005$ DMH ^{LPB} blocking vs. GFP, $P=0.1258$
S5f	POA ^{LPB} -blocking: 7 mice DMH ^{LPB} -blocking: 7 mice GFP control: 7 mice	Ordinary one-way ANOVA factor: treatment (POA ^{LPB} -blocking, DMH ^{LPB} -blocking, GFP control) Tukey's multiple comparisons test	Dark: Treatment: $F(2, 18) = 3.286, P=0.0607$ Multiple comparisons: POA ^{LPB} blocking vs. DMH ^{LPB} blocking, $P=0.1670$ POA ^{LPB} blocking vs. GFP, $P=0.8535$ DMH ^{LPB} blocking vs. GFP, $P=0.0623$ Light: Treatment: $F(2, 18) = 7.078, P=0.0054$ Multiple comparisons: POA ^{LPB} blocking vs. DMH ^{LPB} blocking, $P=0.0678$ POA ^{LPB} blocking vs. GFP, $P=0.0043$ DMH ^{LPB} blocking vs. GFP, $P=0.4060$
S7g	GFP: 7 mice TeNT: 9 mice	RM two-way ANOVA factor one: virus (GFP, TeNT) factor two: time Šidák's multiple comparisons test	Virus: $F(1, 14) = 30.61$ Time: $F(2.366, 32.19) = 23.09$, <i>Geisser-Greenhouse's epsilon</i> , 0.04929 Interaction: $F(48, 653) = 11.95$ Multiple comparisons: 90 min – 150 min, $P<0.0152$
S7j	GFP: 5 mice TeNT: 7 mice	RM two-way ANOVA factor one: virus (GFP, TeNT) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 10) = 17.18, P=0.0020$ Time: $F(31, 310) = 10.98, P<0.0001$ Interaction: $F(31, 310) = 4.533, P<0.0001$ Multiple comparisons: 70 min – 140 min, $P<0.0288$
S7m	GFP: 4 mice TeNT: 7 mice	RM two-way ANOVA factor one: virus (GFP, TeNT) factor two: time Bonferroni's multiple comparisons test	Virus: $F(1, 9) = 5.940, P=0.0375$ Time: $F(48, 432) = 28.06, P<0.0001$ Interaction: $F(48, 432) = 7.574, P<0.0001$ Multiple comparisons: 90 min – 180 min, $P<0.0254$
S9d	mCherry: 6 mice Chr2: 6 mice	RM two-way ANOVA factor one: virus (mCherry, Chr2) factor two: time Uncorrected Fisher's LSD test	Time: $F(2.154, 21.54) = 5.879, P=0.0081$ Virus: $F(1, 10) = 5.952, P=0.0349$ Interaction: $F(90, 900) = 4.427, P<0.0001$ Multiple comparisons: 13 min – 42 min, $P<0.0455$
S9g	Saline: 7 mice CNO: 7 mice	RM two-way ANOVA factor one: treatment (Saline, CNO) factor two: time Šidák's multiple comparisons test	Time: $F(3.850, 46.20) = 13.31, P<0.0001$ Virus: $F(1, 12) = 14.28, P=0.0026$ Interaction: $F(21, 252) = 3.975, P<0.0001$ Multiple comparisons: 20 min – 40 min, $P<0.0204$ 60 min – 90 min, $P<0.0199$
S9i	Saline: 12 mice CNO: 12 mice	RM two-way ANOVA factor one: treatment (Saline, CNO) factor two: time Šidák's multiple comparisons test	Time: $F(5.349, 117.7) = 4.384, P=0.0008$ Virus: $F(1, 22) = 28.07, P<0.0001$ Interaction: $F(21, 462) = 3.374, P<0.0001$ Multiple comparisons: 20 min – 130 min, $P<0.0313$ 150 min, $P=0.0076$ 170 min-180 min, $P<0.0018$

(table continued on the next page)

Supplementary Table 2. Summary of statistical analyses

Figure	Sample size (n)	Statistical test	P values
S10b	GFP: 6 mice ChR2: 9 mice	RM two-way ANOVA factor one: virus (GFP, ChR2) factor two: time Uncorrected Fisher's LSD test	Time: $F(3.876, 50.39) = 11.51, P < 0.0001$ Virus: $F(1, 13) = 1.662, P = 0.2198$ Interaction: $F(90, 1170) = 7.278, P < 0.0001$ Multiple comparisons: 4 min – 35 min, $P < 0.0418$
S10f	mCherry: 6 mice TeNT: 6 mice	Two-tailed unpaired t test	$t = 1.293, df = 10,$ $P = 0.2251$
	mCherry: 6 mice TeNT: 6 mice	Two-tailed unpaired t test	$t = 1.677, df = 10,$ $P = 0.1245$
S10g	mCherry: 7 mice TeNT: 6 mice	RM two-way ANOVA factor one: virus (mCherry, TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 11) = 7.392, P = 0.0200$ Time: $F(90.00, 990.0) = 2.188, P < 0.0001$ Interaction: $F(90, 990) = 8.050, P < 0.0001$ Multiple comparisons: 7 min – 42 min, $P < 0.0415$
S10h	mCherry: 7 mice TeNT: 6 mice	RM two-way ANOVA factor one: virus (mCherry, TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 11) = 4.405, P = 0.0597$ Time: $F(90, 990) = 3.534, P < 0.0001$ Interaction: $F(90, 990) = 2.707, P < 0.0001$ Multiple comparisons: 1 min – 3 min, $P < 0.0448$ 6 min – 19 min, $P < 0.0457$ 21 min – 24 min, $P < 0.0404$ 30 min, $P = 0.0406$ 33 min – 34 min, $P < 0.0335$
S10i	mCherry: 5 mice TeNT: 4 mice	RM two-way ANOVA factor one: virus (mCherry, TeNT) factor two: time Šídák's multiple comparisons test	Virus: $F(1, 7) = 5.880, P = 0.0458$ Time: $F(2.537, 17.76) = 4.565, P = 0.0190$ Interaction: $F(11, 77) = 2.039, P = 0.0356$ Multiple comparisons: 10 min, $P = 0.0217$
S10j	mCherry: 5 mice TeNT: 4 mice	RM two-way ANOVA factor one: virus (mCherry, TeNT) factor two: time Šídák's multiple comparisons test	Virus: $F(1, 7) = 1.922, P = 0.2082$ Time: $F(6, 42) = 3.137, P = 0.0124$ Interaction: $F(6, 42) = 3.162, P = 0.0119$ Multiple comparisons: 80 min, $P = 0.0344$
S10m	GFP: 6 mice TeNT: 5 mice	RM two-way ANOVA factor one: virus (GFP, TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 9) = 3.135, P = 0.1104$ Time: $F(1, 9) = 24.71, P = 0.0008$ Interaction: $F(1, 9) = 3.036, P = 0.1154$ Multiple comparisons: Light, $P = 0.5038$ Dark, $P = 0.0275$
	GFP: 6 mice TeNT: 5 mice	RM two-way ANOVA factor one: virus (GFP, TeNT) factor two: time Uncorrected Fisher's LSD test	Virus: $F(1, 9) = 3.809, P = 0.0827$ Time: $F(1, 9) = 13.09, P = 0.0056$ Interaction: $F(1, 9) = 1.791, P = 0.2137$ Multiple comparisons: Light, $P = 0.6648$ Dark, $P = 0.0318$
S10n	GFP: 6 mice TeNT: 6 mice	RM two-way ANOVA factor one: virus (GFP, TeNT) factor two: time Šídák's multiple comparisons test	Virus: $F(1, 10) = 34.35, P = 0.0002$ Time: $F(3.926, 39.26) = 6.699, P = 0.0004$ Interaction: $F(91, 910) = 6.330, P < 0.0001$ Multiple comparisons: 11 min-18 min, $P < 0.0463$ 37 min-38 min, $P < 0.0418$ 41 min, $P = 0.0476$
S10o	GFP: 6 mice TeNT: 6 mice	RM two-way ANOVA factor one: virus (GFP, TeNT) factor two: time Šídák's multiple comparisons test	Virus: $F(1, 10) = 9.150, P = 0.0128$ Time: $F(1, 10) = 19.65, P = 0.0013$ Interaction: $F(1, 10) = 0.3412, P = 0.5721$ Multiple comparisons: -30-0 min VS. 0-30 min: TeNT, $P = 0.0106$ GFP, $P = 0.0426$ TeNT VS. GFP: -30-0 min, $P = 0.0229$ 0-30 min, $P = 0.0119$