## Supplementary Table 1: Neuronal dynamics of thalamic and cortical neurones across spontaneous sleep-wake states, optogenetic perturbation and recovery sleep.

	No. Cells	No. Animals	Spike Rate (spikes/s)		UP-state lag (ms) (Baseline)		Entrainment lag (ms)		UP-state Lag (ms) (Recovery Sleep)		Slope Change		
			Wake	NREM	REM	Spikes	LFP	Spikes	LFP	Spikes	LFP	Spike	LFP
CMT	9	6	$7.0 \pm 0.4$	$4.8\pm0.2$	$25.7\pm0.8$	$-58.9 \pm 17.7$	$-49.8 \pm 14.7$	$1.8\pm0.6$	$2.8\pm0.4$	$\textbf{-76.8} \pm 10.6$	$-69.9\pm8.2$	$24.6 \pm 15.2$	$22.4\pm13.5$
CING	8	6	$5.1\pm0.1$	$3.7\pm0.2$	$24.5\pm1.1$	$-20.6 \pm 13.9$	$-21.3\pm18.3$	$9.4\pm0.5$	$11.6\pm0.9$	$-20.4\pm6.7$	$-30.5\pm9.8$	$25.8 \pm 16.2$	$21.6 \pm 12.6$
AD	9	6	$8.7\pm0.3$	$5.3 \pm 0.2$	$26.6\pm1.0$	$-7.9\pm25.4$	$-3.5\pm13.11$	$43.0\pm1.5$	$45.4\pm1.6$	$5.3\pm10.5$	$7.9\pm6.5$	$19.4 \pm 13.7$	$17.4\pm11.6$
BARR	9	6	$9.2\pm0.5$	$4.6 \pm 0.2$	$23.8\pm0.9$	$47.4\pm25.3$	$9.3\pm11.7$	$63.0\pm5.3$	$65.6\pm1.6$	$42.4\pm42.6$	$37.0\pm6.3$	$-13.2\pm9.1$	$-13.1\pm9.1$
V2	8	6	6.9 ±0.7	$3.6 \pm 0.4$	$24.8 \pm 1.0$	$20.7\pm20.4$	$13.7\pm12.1$	$60.2\pm1.9$	$58.8\pm2.0$	$26.5\pm11.6$	$26.4\pm8.2$	$19.2\pm11.3$	$18.4\pm14.6$
Reun.	23	6	$5.3\pm0.5$	$4.7 \pm 0.3$	$25.5\pm1.1$	$-44.1\pm9.8$	$-48.4\pm6.7$	-	-	$-33.3 \pm 9.4$	$-32.4\pm9.3$	$-3.2\pm16.2$	$-3.1\pm15.8$
Rhomb.	7	6	$6.7\pm0.3$	$5.5\pm0.6$	$26.7\pm1.5$	$-59.9 \pm 15.5$	$-42.7\pm6.2$	-	-	$-32.8\pm9.2$	$-33.7\pm9.5$	$\textbf{-13.2}\pm9.8$	$\textbf{-16.3} \pm \textbf{4.8}$
IMD	28	6	$9.2\pm0.5$	$5.6\pm0.4$	$22.8 \pm 1.4$	$2.8\pm15.6$	$5.6\pm30.4$	-	-	$16.8\pm7.8$	$15.8\pm7.7$	$-19.0\pm8.5$	$-16.4\pm8.1$
PVT	8	6	6.9 ±1.2	$3.9 \pm 1.4$	$23.8 \pm 1.2$	$4.3 \pm 36.6$	$28.6 \pm 15.1$	-	-	8.9±11.9	9.1±12.1	$\textbf{-11.9} \pm 9.8$	$-12.5\pm8.4$

**Supplementary Table 1:** Values presented as averaged spiking rates  $\pm$  S.E.M.

## Supplementary Table 2: Numbers of cells and animals recorded for each experiment.

	Condition	Number	Number						
		of Cells	of Animals						
Fig 1. S	unnlementary	/ Fig 12.a h	Animais						
116.1,0	apprenientary	1 Ig. 124, 0							
CING	Control	13	6						
PVT	Comroi	8	0						
IMD		28							
CMT		20							
RHO		7							
REU		23							
Fig. 2: Si	upplementary	7 Fig. 2.							
Supplementary Fig. 12c, d, e									
CMT	Control	8	6						
VB		8	-						
Fig. 4; S	upplementary	Fig. 6							
0 /		0							
CMT	ChR2/	9	6						
CING	ArchT	8	0						
AD	11/0/11	9							
BARR		9							
VIS		8							
Fig. 5C.	D. E. F	0							
1.g. 0 0,	2, 2, 1								
CINC	AuchT	0	6						
DADD	Arcn1	9	0						
BAKK		0							
VIS Fig. 5K	I M	0							
г ig. эк,	L, NI								
BARR	ArchT	6	5						
VIS 6									
VIS		6	10						
VIS Fig. 5P,	Q, R; Suppler	6 nentary Fig.	. 10						
VIS Fig. 5P,	Q, R; Suppler	6 nentary Fig.	- <b>10</b>						
VIS Fig. 5P, 0 AD BARR	<b>Q, R; Suppler</b> Ipsi. ArchT	6 nentary Fig. 11 8	- <b>10</b>						
VIS Fig. 5P, 4 AD BARR VIS	<b>Q, R; Supple</b> Ipsi. ArchT	6 nentary Fig. 11 8 12	6 6						
VIS Fig. 5P, 0 AD BARR VIS AD	<b>Q, R; Supple</b> Ipsi. ArchT Contra.	6 nentary Fig. 11 8 12 9	6 6						
VIS Fig. 5P, 9 AD BARR VIS AD BARR	<b>Q, R; Supple</b> Ipsi. ArchT Contra.	6 nentary Fig. 11 8 12 9 9	6						
VIS Fig. 5P, 1 AD BARR VIS AD BARR VIS	<b>Q, R; Supple</b> Ipsi. ArchT Contra.	6 nentary Fig. 11 8 12 9 9 9 11	<b>10</b> 6						
VIS Fig. 5P, AD BARR VIS AD BARR VIS Fig. 6C,	Q, R; Supplei Ipsi. ArchT Contra. D, E, F	6 nentary Fig. 11 8 12 9 9 9 11	<b>10</b> 6						
VIS Fig. 5P, AD BARR VIS AD BARR VIS Fig. 6C,	Q, R; Suppler Ipsi. ArchT Contra. D, E, F	6 nentary Fig. 11 8 12 9 9 9 11	<b>10</b> 6						
VIS Fig. 5P, 4 AD BARR VIS BARR VIS Fig. 6C, CING	Q, R; Suppler Ipsi. ArchT Contra. D, E, F	6 nentary Fig. 11 8 12 9 9 11 11	<b>10</b> 6						
VIS Fig. 5P, 4 AD BARR VIS BARR VIS Fig. 6C, CING BARR	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2	6 nentary Fig. 11 8 12 9 9 11 11 8 6	<b>10</b> 6 6						
VIS Fig. 5P, BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2	6 nentary Fig. 11 8 12 9 9 9 11 8 6 7	<b>10</b> 6 6						
VIS Fig. 5P, / BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7	6 nentary Fig. 11 8 12 9 9 11 8 6 7	<b>10</b> 6 6						
VIS Fig. 5P, / BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7	6 nentary Fig. 11 8 12 9 9 11 8 6 7	<b>10</b> 6 6						
VIS Fig. 5P, / AD BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7	6 nentary Fig. 11 8 12 9 9 11 8 6 7	10           6           6           6						
VIS Fig. 5P, / BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7 ChR2/ ArchT	6 nentary Fig. 11 8 12 9 9 11 8 6 7	10           6           6           5						
VIS Fig. 5P, AD BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING AD	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7 ChR2/ ArchT	6 nentary Fig. 11 8 12 9 9 11 8 6 7 7 6 7 5	10       6       6       5						
VIS Fig. 5P, AD BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING AD BARB	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7 ChR2/ ArchT	6 nentary Fig. 11 8 12 9 9 11 8 6 7 7 6 7 5 6	10       6       6       5						
VIS Fig. 5P, / BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING AD BARR VIS	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7 ChR2/ ArchT	6 nentary Fig. 11 8 12 9 9 9 11 8 6 7 7 5 6 7	10           6           6           5						
VIS Fig. 5P, / BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING AD BARR VIS Supplem	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7 ChR2/ ArchT	6 nentary Fig. 11 8 12 9 9 9 11 8 6 7 5 6 7 5 6 7	10       6       6       5						
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VIS Fig. 5P, / BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING AD BARR VIS Supplem CMT	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 ChR2/ ArchT ChR2/ ArchT eentary Fig. 9 ChR2	6 nentary Fig. 11 8 12 9 9 9 11 8 6 7 5 6 7 5 6 7 7 5 6 7 7	10       6       6       5       6						
VIS Fig. 5P, / BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING AD BARR VIS Supplem CMT CING	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7 ChR2/ ArchT eentary Fig. 9 ChR2	6 nentary Fig. 11 8 12 9 9 9 11 8 6 7 5 6 7 7 5 6 7 7	10         6         6         5         6						
VIS Fig. 5P, / BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING AD BARR VIS Supplem CMT CING BARR	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7 ChR2/ ArchT ChR2/ ArchT ChR2/ ArchT ChR2/ CHR2	6 nentary Fig. 11 8 12 9 9 11 8 6 7 7 5 6 7 7 6 7 6 7 7 6 6 7	10         6         6         5         6         6						
VIS Fig. 5P, / BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING AD BARR VIS Supplem CMT CING BARR VIS	Q, R; Suppler  Ipsi. ArchT  Contra.  D, E, F  ChR2  entary Fig. 7  ChR2/ ArchT  entary Fig. 9  ChR2  entary Fig. 1	6 nentary Fig. 11 8 12 9 9 11 8 6 7 7 6 6 7 7 6 6 7 7 0	10         6         6         5         6         6						
VIS Fig. 5P, AD BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING AD BARR VIS Supplem CMT CING BARR Supplem	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 eentary Fig. 7 ChR2/ ArchT eentary Fig. 9 ChR2 eentary Fig. 1	6 nentary Fig. 11 8 12 9 9 11 8 6 7 7 6 6 7 7 6 6 7 7 0	10         6         6         5         6						
VIS Fig. 5P, AD BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING BARR VIS Supplem CMT CING BARR Supplem CING	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2	6 nentary Fig. 11 8 12 9 9 11 8 6 7 7 6 6 7 7 6 6 7 7 6 6 7 7 0	10         6         6         5         6         4						
VIS Fig. 5P, AD BARR VIS AD BARR VIS Fig. 6C, CING BARR VIS Supplem CMT CING BARR VIS Supplem CMT CING BARR VIS Supplem CMT CING BARR	Q, R; Suppler Ipsi. ArchT Contra. D, E, F ChR2 ChR2 ChR2 ChR2 ChR2 ChR2 ChR2 ChR2	6 nentary Fig. 11 8 12 9 9 11 8 6 7 7 6 6 7 6 7 6 6 7 0 9 9 8	10         6         6         5         6         4						

**Supplementary Table 2:** Numbers represent multisite recording from animals in each experiment.

Supplementary Table 3: Sleep-wake transitions during acute optogenetics stimulation of thalamic neurons and efferent targets during NREM sleep.

			Latencies to awakenings (s)				
		No. Animals	5 Hz	10 Hz	20 Hz	1 s	
CMT	ChR2	6	$2.2 \pm 0.9$	-	$1.1 \pm 0.6$	$0.7 \pm 0.1$	
	EYFP	6	$51.3 \pm 1.7$	-	$46.6\pm0.9$	$51.6 \pm 1.9$	
VB	ChR2	6	$49.8\pm0.8$	-	$50.5 \pm 0.5$	$44.5 \pm 4.2$	
	EYFP	6	$53.5 \pm 1.5$	-	$49.5\pm1.5$	$52.0 \pm 1.0$	
CING	ChR2	5	$1.2 \pm 0.2$	$2.9 \pm 0.6$	$2.1 \pm 0.6$	$1.3 \pm 0.4$	
CING	None	6	$54.1 \pm 1.6$	-	$55.3 \pm 1.7$	$54.0 \pm 1.3$	
(control)							
Insular	ChR2	5	$54.1 \pm 1.6$	$53.5\pm0.4$	$52.3\pm0.9$	$54.0\pm0.4$	
ZI	ChR2	5	$53.9\pm0.9$	$51.3 \pm 1.7$	$54.0 \pm 1.4$	$53.5\pm0.3$	

**Supplementary Table 3:** Values presented as averaged time to awakening  $\pm$  S.E.M.