

Supporting Information

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Table S1. Lamina-specific responses of neurons to forepaw electrical stimulation

	Control				Denervated			
	S1 ipsilateral to FP		S1 contralateral to FP		S1 ipsilateral to FP		S1 contralateral to FP	
	AP < 0.5	AP > 0.5	AP < 0.5	AP > 0.5	AP < 0.5	AP > 0.5	AP < 0.5	AP > 0.5
Neurons responding to forepaw electrical stimulation (%)								
III	0	0	0	0	0	0	0	2
IV	0	0	0	11	6	4	4	19
V + VI	0	4	0	68	19	15	4	42
Sum of responded neurons (%)	4		79		43		71	
Number of isolated neurons	25		28		54		48	

The percentage of the population of neurons exhibiting short action potential (AP; AP < 0.5 ms) and long AP (AP > 0.5 ms) durations in different laminae responding to intact forepaw (FP) electrical stimulation is shown for control and denervated rats in primary somatosensory cortex (S1).

Table S2. Lamina-specific responses of neurons to illumination of eNpHR

	Control				Denervated			
	S1 ipsilateral to FP		S1 contralateral to FP		S1 ipsilateral to FP		S1 contralateral to FP	
	AP < 0.5	AP > 0.5	AP < 0.5	AP > 0.5	AP < 0.5	AP > 0.5	AP < 0.5	AP > 0.5
Neurons showing decreased firing rate (%)								
III	0	4	0	0	0	1.85	0	0
IV	0	8	0	7.14	5.56	1.85	4.17	12.50
V + VI	4	4	0	17.86	3.70	1.85	4.17	33.33
Neurons showing increased firing rate (%)								
III	0	4	0	0	3.70	3.70	0	0
IV	16	0	0	3.57	7.41	11.11	0	6.25
V + VI	4	44	0	21.43	24.07	24.07	2.08	16.67

The percentage of the population of neurons exhibiting short (AP < 0.5 ms) and long (AP > 0.5 ms) AP durations in different laminae increasing and decreasing their firing rate in response to illumination of halorhodopsin (eNpHR) over the right primary somatosensory cortex (S1) is shown for control and denervated rats in S1.

Table S3. Lamina-specific average changes of neuronal firing rates to illumination of eNpHR

	Control								Denervated							
	S1 ipsilateral to FP				S1 contralateral to FP				S1 ipsilateral to FP				S1 contralateral to FP			
	AP < 0.5		AP > 0.5		AP < 0.5		AP > 0.5		AP < 0.5		AP > 0.5		AP < 0.5		AP > 0.5	
	Hz	%	Hz	%	Hz	%	Hz	%	Hz	%	Hz	%	Hz	%	Hz	%
III	—	—	0.80	-48.15	—	—	—	—	0.85	0	6.37	-12.22	—	—	—	—
IV	1.29	0	0.40	-37.50	—	—	0.76	-40.00	1.32	-44.35	2.17	-43.18	1.68	-21.08	4.87	-26.58
V + VI	0.63	-20.00	2.70	-33.33	—	—	4.41	-20.06	2.41	-27.85	4.44	0	1.05	-30.29	6.01	-30.84
III	—	—	0.80	19.05	—	—	—	—	0.85	168.64	6.37	52.70	—	—	—	—
IV	1.29	185.68	0.40	—	—	—	0.76	3.41	1.32	76.71	2.17	192.05	1.68	0	4.87	48.67
V + VI	0.63	125.00	2.70	167.30	—	—	4.41	30.40	2.41	149.25	4.44	113.95	1.05	130.77	6.01	24.32

The average percentages of increases and decreases in firing rates (%) of neurons exhibiting short (AP < 0.5 ms) and long (AP > 0.5 ms) AP durations in different laminae induced by 30 s of illumination of eNpHR over the right primary somatosensory cortex (S1) were compared with 30 s of spontaneous firing rates (Hz) for control and denervated rats.

Table S4. Lamina-specific average changes of neuronal firing rates to illumination of eNpHR in conjunction with forepaw electrical stimulation

	Control								Denervated							
	S1 ipsilateral to FP				S1 contralateral to FP				S1 ipsilateral to FP				S1 contralateral to FP			
	AP < 0.5		AP > 0.5		AP < 0.5		AP > 0.5		AP < 0.5		AP > 0.5		AP < 0.5		AP > 0.5	
	Hz	%	Hz	%	Hz	%	Hz	%	Hz	%	Hz	%	Hz	%	Hz	%
III	—	—	1.20	-39.47	—	—	—	—	1.17	-24.19	5.04	-13.10	—	—	1.48	0
IV	2.36	-15.18	0.5	-50	—	—	1.24	-13.03	1.4	-60.99	3.19	-50.32	2.3	-3.64	4.24	-6.25
V + VI	1.62	-93.44	3.17	-53.69	—	—	5.34	-32.69	4.43	-18.62	4.72	-7.09	1.75	-28.19	6.12	-21.17
III	—	—	1.20	11.76	—	—	—	—	1.17	125	5.04	65.22	—	—	1.48	0
IV	2.36	227.50	0.5	0	—	—	1.24	24.11	1.4	63.57	3.19	64.62	2.3	8.43	4.24	27.14
V + VI	1.62	55.56	3.17	85.42	—	—	5.34	13.64	4.43	58.33	4.72	68.68	1.75	38.71	6.12	49.13

The average percentages of increases and decreases in firing rates (%) of neurons exhibiting short (AP < 0.5 ms) and long (AP > 0.5 ms) AP durations in different laminae induced by 30 s of intact forepaw (FP) electrical stimulation combined with illumination of eNpHR over the right primary somatosensory cortex (S1) were compared with the firing rates (Hz) induced by 30 s of intact FP electrical stimulation for control and denervated rats.

Table S5. Cortical depth-specific average changes of the current source density sink and source values induced by illumination of eNpHR in conjunction with forepaw electrical stimulation

Depth (μm)	Control S1 ipsilateral to FP				Denervated S1 ipsilateral to FP			
	Light off		Light on		Light off		Light on	
	Sink (%)	Source (%)	Sink (%)	Source (%)	Sink (%)	Source (%)	Sink (%)	Source (%)
300	—	—	—	—	5.90 ± 3.31	11.59 ± 2.88	8.39 ± 2.58	16.22 ± 2.78
450	7.09 ± 2.42	19.50	—	—	9.31 ± 5.08	10.12	11.28 ± 3.08	15.09 ± 3.91
600	13.27	40.79 ± 17.03	—	4.44	6.68 ± 0.53	11.84 ± 1.49	19.70 ± 7.47	7.88 ± 3.46
750	7.94 ± 1.53	—	16.88	10.56 ± 1.44	7.46 ± 2.12	13.12 ± 3.94	10.73 ± 0.90	8.67 ± 2.15
900	15.26	28.63	10.69 ± 1.74	22.56 ± 10.18	14.27 ± 7.18	10.95 ± 1.35	14.19 ± 2.34	8.16 ± 2.56
1,050	9.14 ± 3.22	10.13 ± 3.77	10.34 ± 2.24	11.48	10.99 ± 2.32	31.97	10.13 ± 4.13	10.40 ± 4.58
1,200	7.54 ± 3.36	13.04	10.55 ± 4.03	12.13 ± 4.12	12.74 ± 1.16	24.29 ± 7.15	11.14 ± 0.71	16.66 ± 4.59
1,350	12.24 ± 1.06	16.19 ± 3.27	9.38 ± 6.32	12.85	15.16 ± 5.67	7.65 ± 3.06	12.77 ± 3.25	10.36 ± 4.48
1,500	20.84 ± 4.45	8.75 ± 1.08	13.58 ± 2.82	11.82 ± 2.27	13.80 ± 6.92	16.04 ± 7.60	5.68 ± 0.87	8.37 ± 3.03
1,650	9.12 ± 0.41	13.42 ± 0.23	12.69 ± 2.63	12.77 ± 8.50	10.52 ± 3.48	11.70 ± 1.89	8.93 ± 3.40	7.64 ± 3.76
1,800	12.24 ± 5.99	12.12 ± 7.61	6.36	23.56	8.90	7.99 ± 2.79	12.20 ± 2.83	9.91 ± 2.73

The average percentages of the current source density values (± SEM) are shown for control and denervated rats in primary somatosensory cortex (S1) ipsilateral to intact forepaw electrical stimulation with (light on) or without illumination (light off) of eNpHR over the right healthy S1. Only significant changes in the sink and source amplitude (Z test analysis with effective significance of $P < 0.05$) are shown.