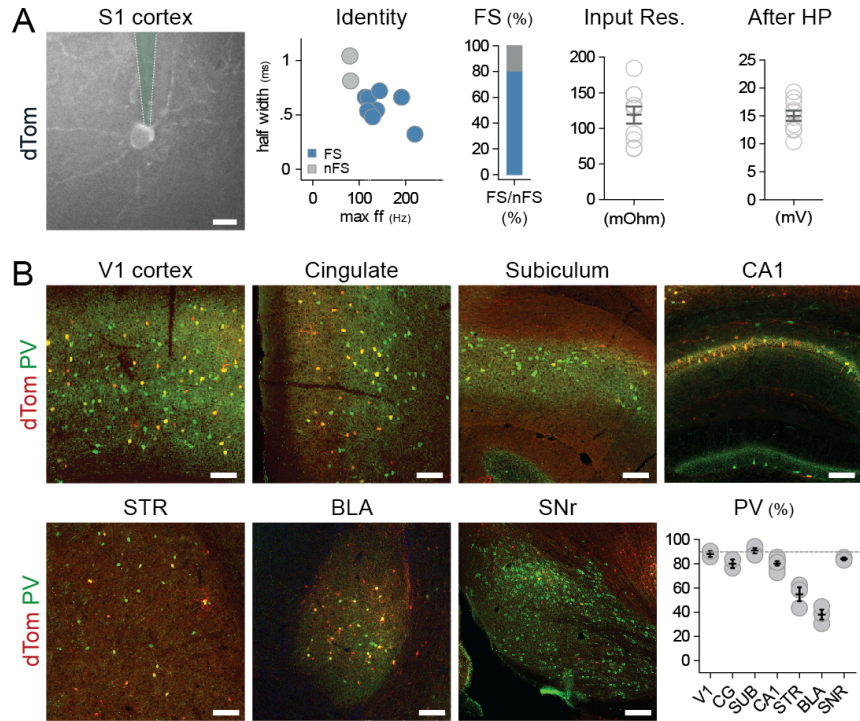
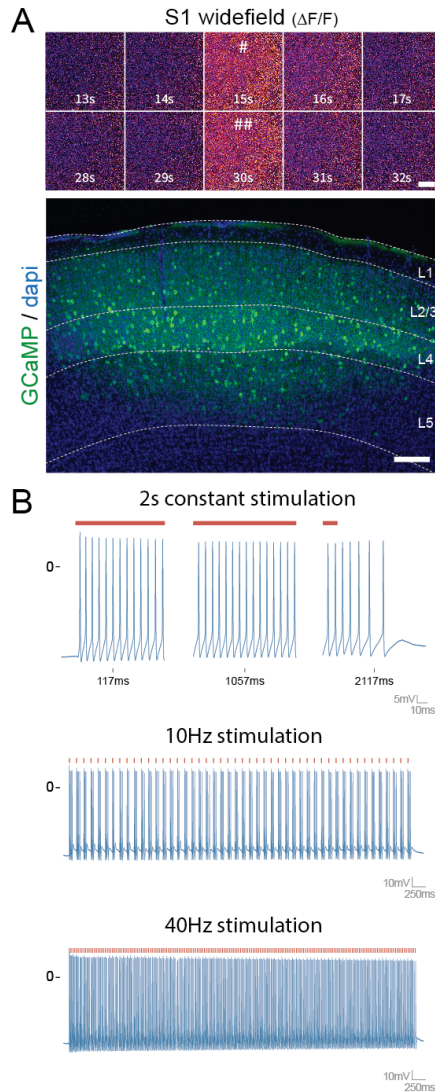


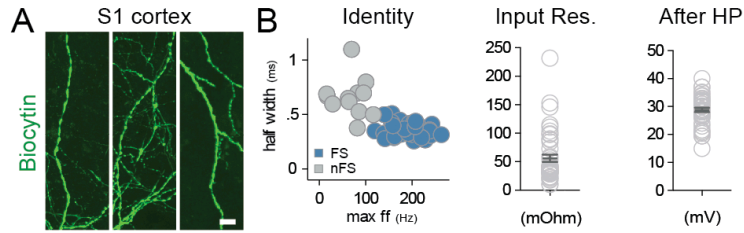
Supplementary figure 1. (A) The *in-situ* hybridization for Scn1a on was downloaded from the Allen Brain Mouse ISH data at <https://mouse.brain-map.org/gene/show/20028> - sagittal image 12. (B) Immunohistochemistry for PV. (C) Adult mice were systemically injected with rAAV-E2-dTomato and immunohistochemistry for the viral reporter was performed after 3 weeks. Scale bars represent 750um.



Supplementary figure 2. Adult mice were injected systemically with rAAVs expressing the reporter C1V1-eYFP (**A**) or dTomato (**B**) under the control of the E2 regulatory element and analyzed 4 weeks post-injection. (**A**) Slice recoding of the intrinsic properties of virally labeled neurons. The left panel shows a representative cell expressing the viral reporter. The green trace represents the recording pipet. The quantifications show the indicated parameters. The blue dots represent cells with stereotypical fast-spiking properties. (**B**). Coronal and sagittal brain sections were analyzed by immunohistochemistry for the reporter and the indicated markers. On the bottom-right panel, the specificity of expression is reported as the proportion of virally labeled cells co-expressing PV. Scale bars represent 20 μ m. On the graphs, the dots represent individual measurements and the lines represent average \pm s.e.m. (see supplementary table 1 for values and n).



Supplementary figure 3. (A) Mice were injected locally in the somatosensory cortex with rAAV-E2-GCaMP6f at P14 and analyzed one-week post-injection. The left panel shows widefield images of two representative peaks shown by the pound sign in figure 3. On the right panel, the success rate was calculated as the proportions of $\Delta F/F$ peaks above threshold in response to whisker stimulation. (B) Mice were injected locally in the somatosensory cortex with rAAV-E2-C1V1-eYFP in adults and analyzed one-week post-injection. Cells expressing the viral reporter were targeted and recording of voltage over 3s upon 2 seconds of constant (A), 10Hz (B) or 40Hz (C) laser stimulation (550nm) were performed. The red bars above the recording traces represent laser stimulation. Dashed lines represent the limits of anatomical structures. On the graphs, the dots represent individual measurements and the lines represent average \pm s.e.m. (see supplementary table 1 for values and n). Scale bars represent 250 μ m.



Supplementary figure 4. Human brain tissue obtained from surgical resection was exposed to either AAV-E2-dTomato and maintained in culture for 7-14 days. Scale bars represent 25 μ m. **(A)** Representative image of the dendrites of virally labeled cells filled with Biocytin during the recording session. **(B)** Slice recording of the intrinsic properties of virally labeled neurons. The quantifications show the indicated parameters. The blue dots represent cells with stereotypical fast-spiking properties. On the graphs, the dots represent individual measurements and the lines represent average \pm s.e.m. (see supplementary table 1 for values and n). Scale bar represent 2 μ m **(A)**.

figure	panel	E	marker	layer	n	mean	s.e.m.
1	B	E1	Reporter	1-6	3	17.1	4.7
1	B	E2	Reporter	1-6	3	78.7	11.4
1	B	E3	Reporter	1-6	3	49.1	5.5
1	B	E4	Reporter	1-6	3	16	2.6
1	B	E5	Reporter	1-6	3	38.3	17
1	B	E6	Reporter	1-6	3	8.1	0.2
1	B	E7	Reporter	1-6	3	10.4	1.4
1	B	E8	Reporter	1-6	3	41.9	9.2
1	B	E9	Reporter	1-6	3	28.2	5.6
1	B	E10	Reporter	1-6	3	22.3	7.2
1	B	Dlx	Reporter	1-6	3	100.1	7.9
1	B	E1	Reporter / Gad1	1-6	2	95.1	4.3
1	B	E2	Reporter / Gad1	1-6	2	97.8	0
1	B	E3	Reporter / Gad1	1-6	2	95	2.8
1	B	E4	Reporter / Gad1	1-6	2	97.6	2.4
1	B	E5	Reporter / Gad1	1-6	2	63.7	1.5
1	B	E6	Reporter / Gad1	1-6	2	98.7	1.3
1	B	E7	Reporter / Gad1	1-6	2	89.5	4
1	B	E8	Reporter / Gad1	1-6	2	85.4	0.5
1	B	E9	Reporter / Gad1	1-6	2	98.6	1.4
1	B	E10	Reporter / Gad1	1-6	2	96.7	2.4
1	B	Dlx	Reporter / Gad1	1-6	4	93.4	1.3
1	B	E1	Reporter / PV	1-6	6	50.3	5.6
1	B	E2	Reporter / PV	1-6	6	74	2.5
1	B	E3	Reporter / PV	1-6	4	45.5	2.1
1	B	E4	Reporter / PV	1-6	6	30.7	3.8
1	B	E5	Reporter / PV	1-6	6	22.8	2.4
1	B	E6	Reporter / PV	1-6	2	16	2
1	B	E7	Reporter / PV	1-6	6	50.8	2.1
1	B	E8	Reporter / PV	1-6	4	47.5	3.4
1	B	E9	Reporter / PV	1-6	6	52.8	6.3
1	B	E10	Reporter / PV	1-6	4	29	2.7
1	C	E2	Reporter / Gad1	1	3	0	0
1	C	E2	Reporter / Gad1	2/3	3	94.7	0.9
1	C	E2	Reporter / Gad1	4	3	100	0
1	C	E2	Reporter / Gad1	5	3	97.1	1
1	C	E2	Reporter / Gad1	6	3	97.2	2.8
1	C	E2	Reporter / PV	1	3	0	0
1	C	E2	Reporter / PV	2/3	3	86.5	2.8
1	C	E2	Reporter / PV	4	3	93.5	1.7
1	C	E2	Reporter / PV	5	3	87.3	2.1
1	C	E2	Reporter / PV	6	3	87.3	2.1
1	C	E2	Reporter / SST	1	3	0	0
1	C	E2	Reporter / SST	2/3	3	0	0
1	C	E2	Reporter / SST	4	3	6.1	0.8
1	C	E2	Reporter / SST	5	3	3.3	1
1	C	E2	Reporter / SST	6	3	7.6	1
1	C	E2	Reporter / VIP	1	3	na	na
1	C	E2	Reporter / VIP	2/3	3	na	na
1	C	E2	Reporter / VIP	4	3	na	na
1	C	E2	Reporter / VIP	5	3	na	na
1	C	E2	Reporter / VIP	6	3	na	na
1	C	E5	Reporter / Gad1	1	3	91.7	8.3
1	C	E5	Reporter / Gad1	2/3	3	98.9	1.1
1	C	E5	Reporter / Gad1	4	3	95.7	0
1	C	E5	Reporter / Gad1	5	3	35	1.7
1	C	E5	Reporter / Gad1	6	3	94.7	5.3
1	C	E5	Reporter / PV	1	3	0	0
1	C	E5	Reporter / PV	2/3	3	36.3	7.7
1	C	E5	Reporter / PV	4	3	15.8	3.8
1	C	E5	Reporter / PV	5	3	17.8	4.5
1	C	E5	Reporter / PV	6	3	12.9	2.1
1	C	E5	Reporter / SST	1	3	0	0
1	C	E5	Reporter / SST	2/3	3	7.1	4.3
1	C	E5	Reporter / SST	4	3	22.4	10.3
1	C	E5	Reporter / SST	5	3	13.1	4.3
1	C	E5	Reporter / SST	6	3	12.3	12.3
1	C	E5	Reporter / VIP	1	3	na	na
1	C	E5	Reporter / VIP	2/3	3	na	na
1	C	E5	Reporter / VIP	4	3	na	na
1	C	E5	Reporter / VIP	5	3	na	na
1	C	E5	Reporter / VIP	6	3	na	na
1	C	E6	Reporter / Gad1	1	3	0	0
1	C	E6	Reporter / Gad1	2/3	3	95.5	4.5
1	C	E6	Reporter / Gad1	4	3	100	0
1	C	E6	Reporter / Gad1	5	3	98.3	1.7
1	C	E6	Reporter / Gad1	6	3	100	0

figure	panel	E	marker	layer	n	mean	s.e.m.
1	C	E6	Reporter / PV	1	3	0	0
1	C	E6	Reporter / PV	2/3	3	5.4	1.4
1	C	E6	Reporter / PV	4	3	3.4	0.6
1	C	E6	Reporter / PV	5	3	2.3	0.6
1	C	E6	Reporter / PV	6	3	1.8	0.3
1	C	E6	Reporter / SST	1	3	0	0
1	C	E6	Reporter / SST	2/3	3	0	0
1	C	E6	Reporter / SST	4	3	7.5	4.6
1	C	E6	Reporter / SST	5	3	5.9	2.6
1	C	E6	Reporter / SST	6	3	2.9	2.9
1	C	E6	Reporter / VIP	1	3	0	0
1	C	E6	Reporter / VIP	2/3	3	92.5	2.6
1	C	E6	Reporter / VIP	4	3	76.3	8.8
1	C	E6	Reporter / VIP	5	3	76.7	3.8
1	C	E6	Reporter / VIP	6	3	96.2	3.8
1	C	E2	Density Gad1+	1	3	0.3	0.5
1	C	E2	Density Gad1+	2/3	3	12.5	1
1	C	E2	Density Gad1+	4	3	30.9	3.1
1	C	E2	Density Gad1+	5	3	35	1.4
1	C	E2	Density Gad1+	6	3	18.8	4.8
1	C	E2	Density Gad1-	1	3	0	0
1	C	E2	Density Gad1-	2/3	3	0.7	0.1
1	C	E2	Density Gad1-	4	3	0	0
1	C	E2	Density Gad1-	5	3	1.1	0.6
1	C	E2	Density Gad1-	6	3	0.7	0.9
1	C	E2	Density Gad1+	1	3	2.2	0.9
1	C	E5	Density Gad1+	2/3	3	22.2	1.5
1	C	E5	Density Gad1+	4	3	12.2	0.5
1	C	E5	Density Gad1+	5	3	18.6	0.3
1	C	E5	Density Gad1+	6	3	8.4	1.9
1	C	E5	Density Gad1-	1	3	0.3	0.4
1	C	E5	Density Gad1-	2/3	3	0.3	0.4
1	C	E5	Density Gad1-	4	3	0.6	0
1	C	E5	Density Gad1-	5	3	34.7	3
1	C	E5	Density Gad1-	6	3	0.6	0.8
1	C	E6	Density Gad1+	1	3	0	0
1	C	E6	Density Gad1+	2/3	3	34.7	7.2
1	C	E6	Density Gad1+	4	3	36.8	1.3
1	C	E6	Density Gad1+	5	3	13.7	6.6
1	C	E6	Density Gad1+	6	3	13.6	1
1	C	E6	Density Gad1-	1	3	0	0
1	C	E6	Density Gad1-	2/3	3	0	0
1	C	E6	Density Gad1-	4	3	0.6	0.9
1	C	E6	Density Gad1-	5	3	0	0
1	C	E6	Density Gad1-	6	3	0.6	0.9
2	B	E2	Reporter / PV	1-6	8	90.8	1.1
2	B	E2	PV / reporter	1-6	19	75.7	2.9
2	D	E2	Reporter at .5	1-6	3	10	1.1
2	D	E2	Reporter at 2	1-6	3	33	10.6
2	D	E2	Reporter at 5	1-6	3	96.5	8.4
2	D	E2	Reporter / PV at .5	1-6	3	86.4	0.5
2	D	E2	Reporter / PV at 2	1-6	3	86.6	0.6
2	D	E2	Reporter / PV at 5	1-6	3	91.3	0.8
2	E	E2	Reporter / PV 1-15	1-6	4	56.7	2.3
2	E	E2	Reporter / PV 7-15	1-6	5	67.2	1.5
2	E	E2	Reporter / PV 10-15	1-6	3	81.7	1.1
2	E	E2	Reporter / PV 4-7	1-6	2	60.9	1.9
2	E	E2	Reporter / PV 7-10	1-6	5	78.1	1.8
3	A	E2	Reporter / PV	1-6	4	85.3	0.6
3	A	E2	PV / reporter	1-6	4	87.7	1.2
3	B	E2	Delta	1-6	14	8.2	0.8
4	A	E2	Rat	1-6	1	93	na
4	A	E2	Marmoset	1-6	4	91.8	3.1
4	A	E2	Macaque	1-6	4	87.3	0.5
S2	A	E2	IR	na	10	119.1	11.8
S2	A	E2	AHP	na	10	15	0.9
S2	B	E2	Reporter / PV V1	1-6	2	88.1	2.3
S2	B	E2	Reporter / PV CG	na	2	80.2	3.7
S2	B	E2	Reporter / PV SUB	na	3	91.1	2.1
S2	B	E2	Reporter / PV CA1	na	6	80.5	1.9
S2	B	E2	Reporter / PV STR	na	3	54.8	5.8
S2	B	E2	Reporter / PV BLA	na	3	38.1	4.1
S2	B	E2	Reporter / PV SNR	na	2	84.2	1.1
S4	A	E2	IR	na	44	56.2	6.7
S4	A	E2	AHP	na	45	28.8	0.8
-	-	-	-	-	-	-	-

Supplementary Table 1. Table containing all the quantification values presented in the figures.