

## Supplementary Data for

# Canonical organization of layer 1 neuron-led cortical inhibitory and disinhibitory interneuronal circuits

Alice J. Lee<sup>1,3,7</sup>, Guangfu Wang<sup>1,7</sup>, Xiaolong Jiang<sup>1,7</sup>, Seraphina M. Johnson<sup>1,4</sup>, Elizabeth T. Hoang<sup>1,5</sup>, Fabien Lanté<sup>1</sup>, Ruth L. Stornetta<sup>1</sup>, Mark P. Beenhakker<sup>1</sup>, Ying Shen<sup>6</sup> & J. Julius Zhu<sup>1,2</sup>

Departments of Pharmacology<sup>1</sup>, Neuroscience<sup>2</sup>, Biology<sup>3</sup>, Chemistry<sup>4</sup> and Psychology<sup>5</sup>, School of Medicine and College of Arts and Sciences, University of Virginia, Charlottesville, VA 22908

And

Department of Neurobiology and Key Laboratory of Medical Neurobiology of Chinese Ministry of Health<sup>6</sup>, Zhejiang University School of Medicine, 388 Yu Hang Tang Rd, Hangzhou 310058, P. R. China

<sup>7</sup>These authors contribute equally.

Figure S1

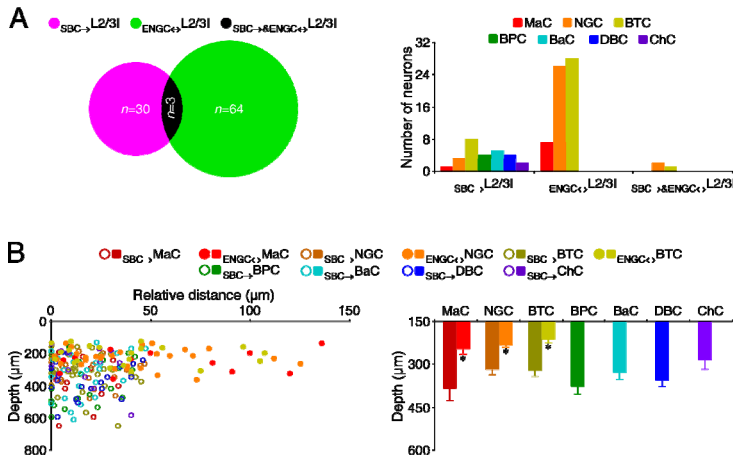


Figure S1. Interneurons innervated by SBCs and ENGCs have different distributions in L2/3.

(A) Left, overlapping circles show the numbers of L2/3 interneurons innervated by SBCs only (SBC<sub>→</sub>L2/3I), ENGCs only (ENGC<sub>→</sub>L2/3I), or both SBCs and ENGCs (SBC<sub>→</sub>ENGC<sub>→</sub>L2/3I). Right, histograms show the numbers of different groups of L2/3 interneurons innervated by SBCs and/or ENGCs. Note that the data were obtained from recordings with a pair of SBC and ENGC neurons recorded simultaneously and L2/3 interneurons were sampled randomly in L2/3, and that two NGCs and one BTC innervated by both SBCs and ENGCs were located in the upper L2/3 close to vertical descending axons of SBCs.

(B) Upper, plot shows the distributions of L2/3 interneurons. Note the origins of X and Y axes indicating the soma location of presynaptic SBCs or ENGCs and the pia. Lower, histograms show the average depths of seven different groups of L2/3 interneurons innervated by SBCs and three different groups of L2/3 interneurons innervated by ENGCs (see Tables 1-2 for values). Asterisks indicate the significant differences in depth between MaCs, NGCs and BTCs innervated by SBCs and ENGCs ( $p < 0.05$ ; Mann-Whitney Rank Sum tests).

Figure S2

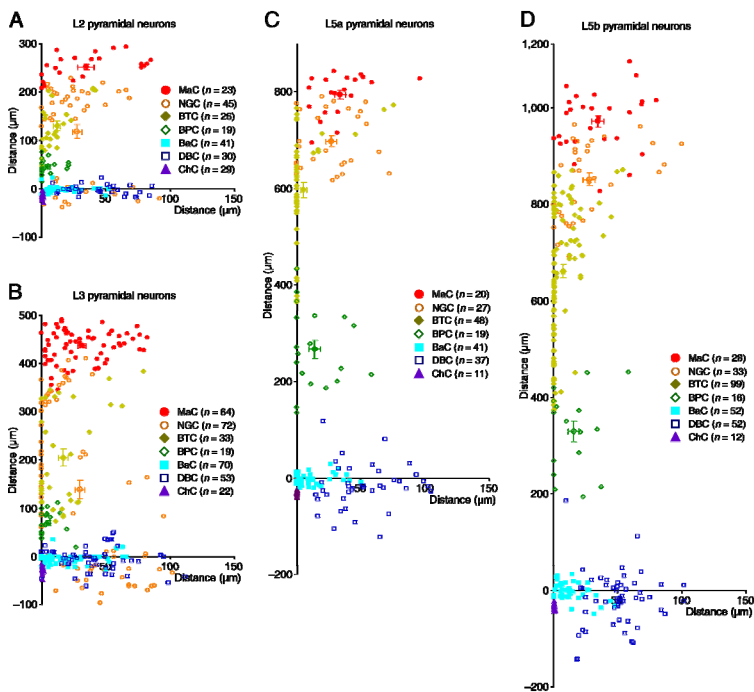


Figure S2. L2/3 interneurons target similar compartments of L2, L3, L5a and L5b pyramidal neurons.

(A) The coordinates, or the horizontal and vertical distance of the synapses made by seven groups of L2/3 interneurons from the soma of L2 pyramidal neurons.

(B) The coordinates, or the horizontal and vertical distance of the synapses made by seven groups of L2/3 interneurons from the soma of L3 pyramidal neurons. Note no significant difference in the relative coordinates of the synapses on L2 and L3 pyramidal neurons ( $p > 0.05$ ; Mann-Whitney Rank Sum tests).

(C) The coordinates, or the horizontal and vertical distance of the synapses made by seven groups of L2/3 interneurons from the soma of L5a pyramidal neurons.

(D) The coordinates, or the horizontal and vertical distance of the synapses made by seven groups of L2/3 interneurons from the soma of L5b pyramidal neurons. Note the inclusion of synapses from previously published L2/3 interneurons (Jiang X et al. 2013) that are anatomically located within the barrel cortex by reanalysis (i.e.,  $n=12$  from 2 SBC<sub>→</sub>MaCs,  $n=16$  from 5 SBC<sub>→</sub>NGCs,  $n=40$  from 8 SBC<sub>→</sub>BTCs,  $n=9$  from 2 SBC<sub>→</sub>BPCs,  $n=22$  from 5 SBC<sub>→</sub>BaCs,  $n=19$  from 5 SBC<sub>→</sub>DBCs and  $n=7$  from 2 SBC<sub>→</sub>ChCs), and no significant difference in the relative coordinates of the synapses on L5a and L5b pyramidal neurons ( $p > 0.05$ ; Mann-Whitney Rank Sum tests).

Figure S3

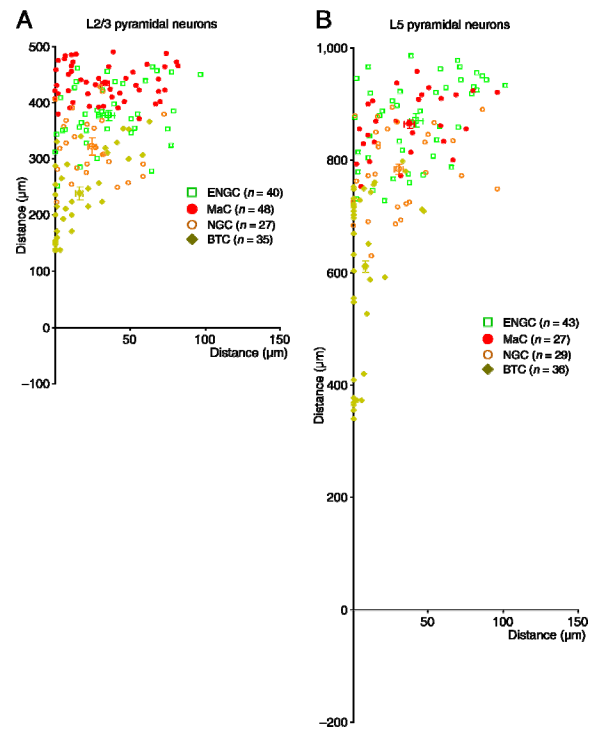


Figure S3. ENGC<sub>→</sub>L2/3 interneuronal circuits target apical dendrites of L2/3 and L5 pyramidal neurons.

(A) The coordinates, or the horizontal and vertical distance of the synapses made by ENGCs and L2/3 interneurons innervated by ENGCs from the soma of L2/3 pyramidal neurons.

(B) The coordinates, or the horizontal and vertical distance of the synapses made by ENGCs and L2/3 interneurons innervated by ENGCs from the soma of L5 pyramidal neurons. Note the inclusion of synapses from previously published L2/3 interneurons (Jiang X et al. 2013) that are anatomically located within the barrel cortex by reanalysis (i.e.,  $n=10$  from 3 ENGCs,  $n=5$  from 1 ENGC<sub>→</sub>MaC,  $n=9$  from 2 ENGC<sub>→</sub>NGCs and  $n=13$  from 2 ENGC<sub>→</sub>BTCs).