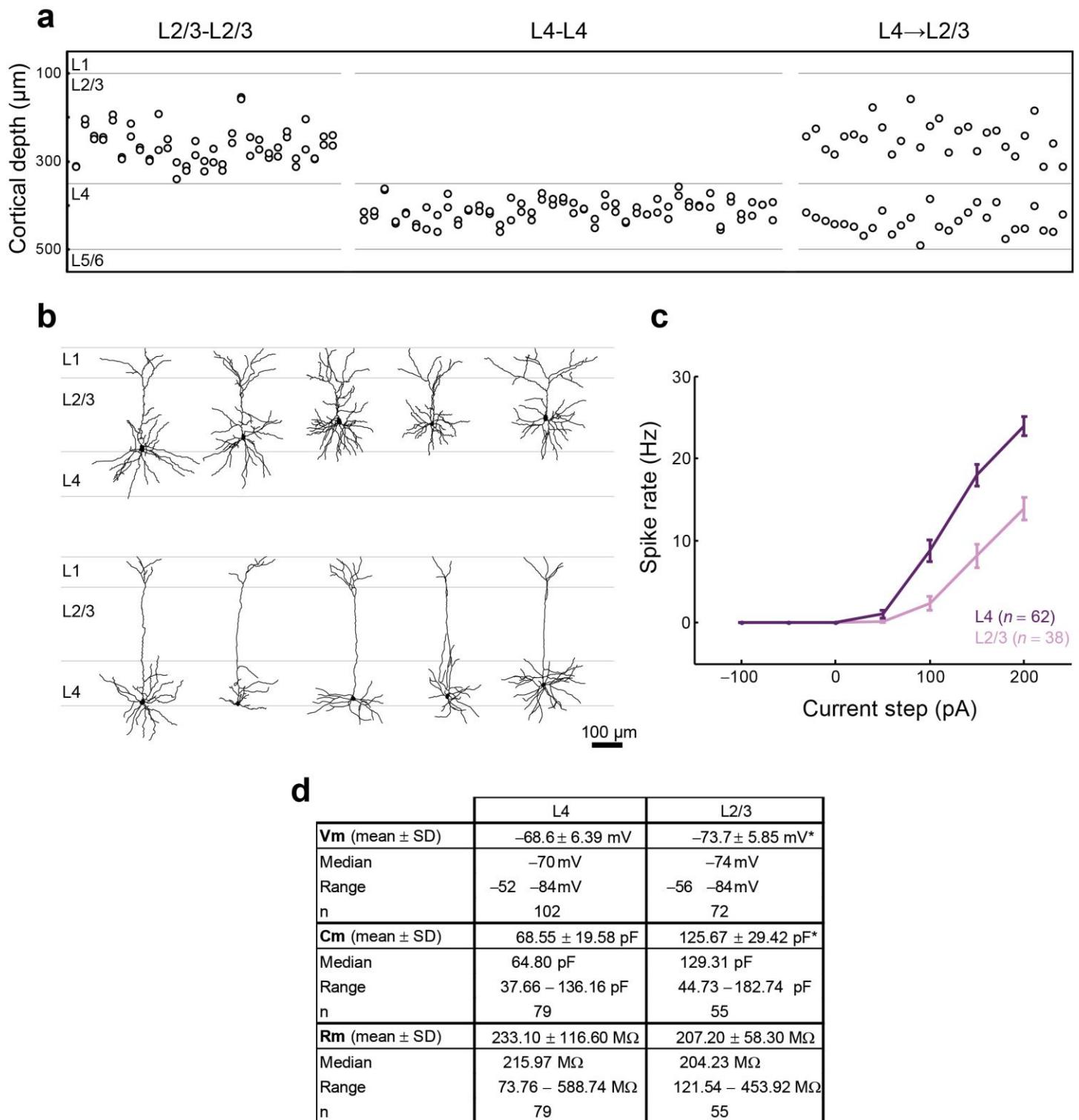


Supplementary Figure 1

dLGN inputs innervate L5 pyramidal neurons in V1.

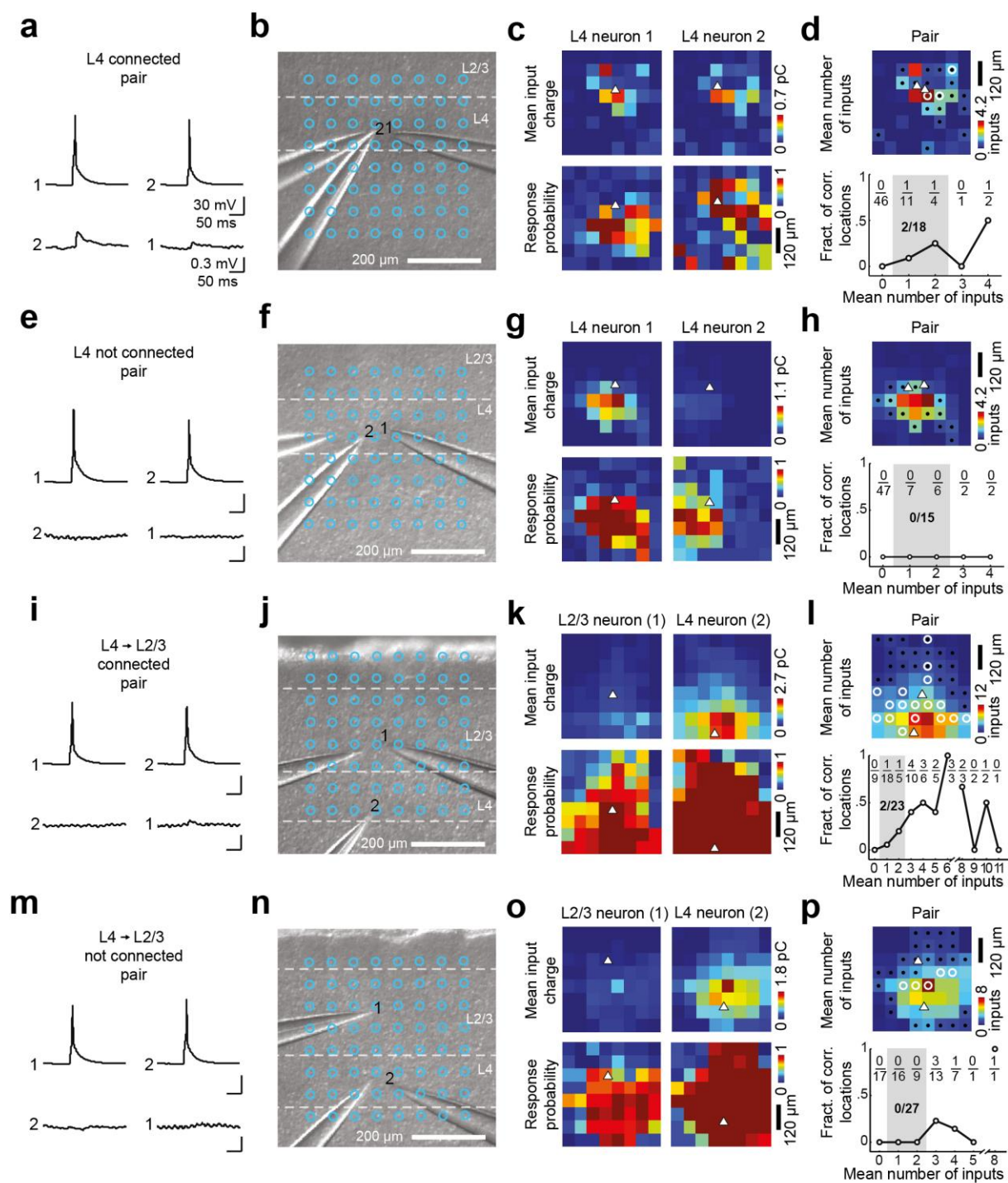
Top. Average sCRACM maps aligned by pia position (white triangles, soma position). Bottom. Average sCRACM maps aligned by soma. Only neurons receiving significant dLGN inputs (3 out of 11 neurons) are plotted.



**Supplementary Figure 2**

Laminar, morphological and electrophysiological differences between L4 and L2/3 pyramidal neurons. **(a)** Laminar position of paired recorded neurons in L4, L2/3 or L4 and L2/3. **(b)** Neuronal dendritic morphology reconstructions from L2/3 (top) or L4 (bottom) neurons. **(c)** Input/output curves from L2/3

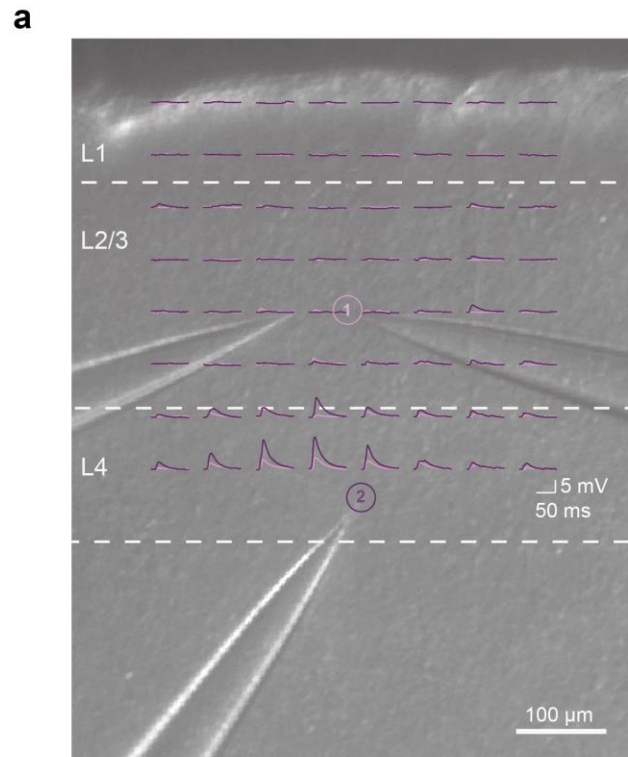
or L4 neurons. **(d)** Intrinsic properties of L4 and L2/3 recorded neurons. Vm:  $P = 3.02 \times 10^{-7}$ , t-test ( $t_{172} = -5.33$ ). Cm:  $P = 1.24 \times 10^{-26}$ , t-test ( $t_{132} = -13.5$ ). Rm:  $P = 0.1312$ , t-test ( $t_{132} = 1.52$ ). Vm: membrane resting potential. Cm: membrane capacitance. Rm: membrane resistance.



### Supplementary Figure 3

Example experiments from connected and nonconnected pairs of neurons in V1.

**(a,e,i,m)** Local connectivity test. Presynaptic spiking elicited for each neuron (top) and the traces simultaneously recorded in the other neuron (bottom). Traces are the mean of 100 repetitions. **(b,f,j,n)** Brightfield image of the brain slice showing the recording pipettes and the photostimulation grid. **(c,g,k,o)** Maps of mean eEPSC charge (top) and response probability (bottom) across photostimulated locations in **b,f,j,n** respectively for each neuron in the pair. White triangles, soma position. **(d,h,l,p)** Top, map of mean number of inputs recruited for the pair at each photostimulated location in the grid (average of top panels in **c,g,k,o** respectively). Mean number of inputs is calculated as the mean eEPSC charge for the pair / TC unitary input size. White circles indicate locations with correlated eEPSCs. Bottom, fraction of correlated locations as function of mean number of inputs. Bin size, 1 input. Shaded area, range used for analyses in **Fig. 4** and **Fig. 5**. Pixels with values within that range are marked with black dots in top panel.



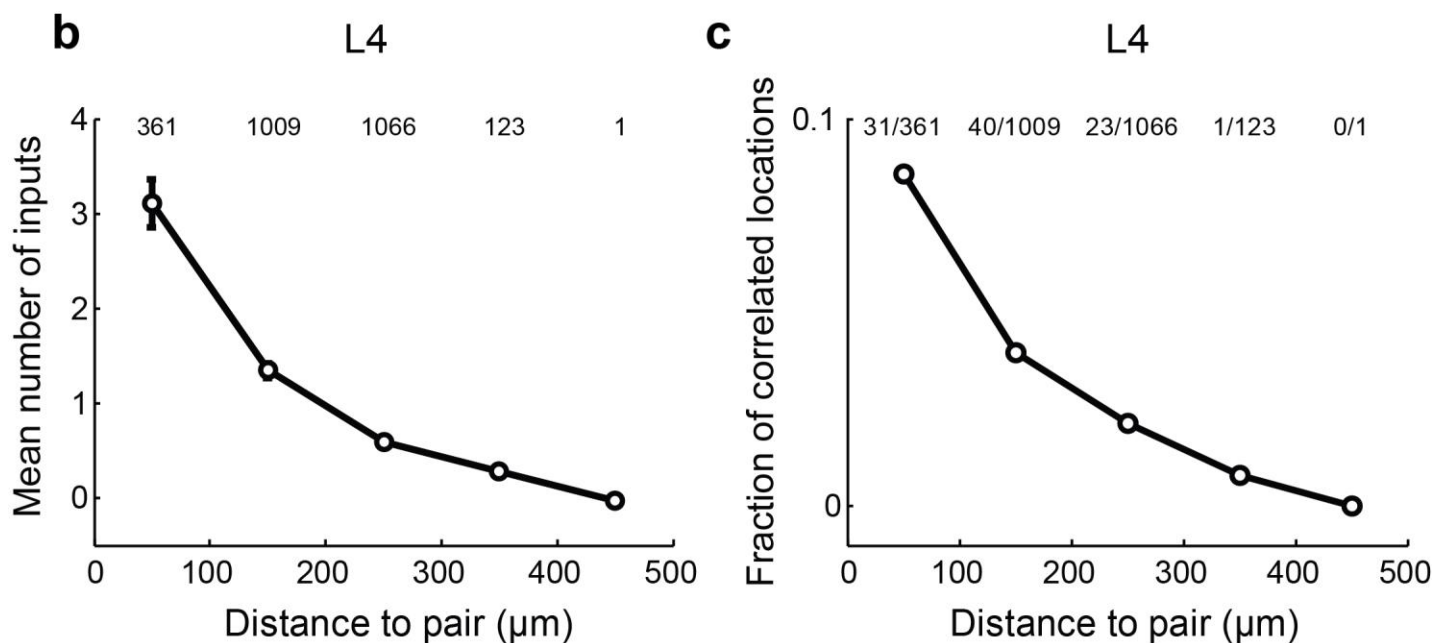
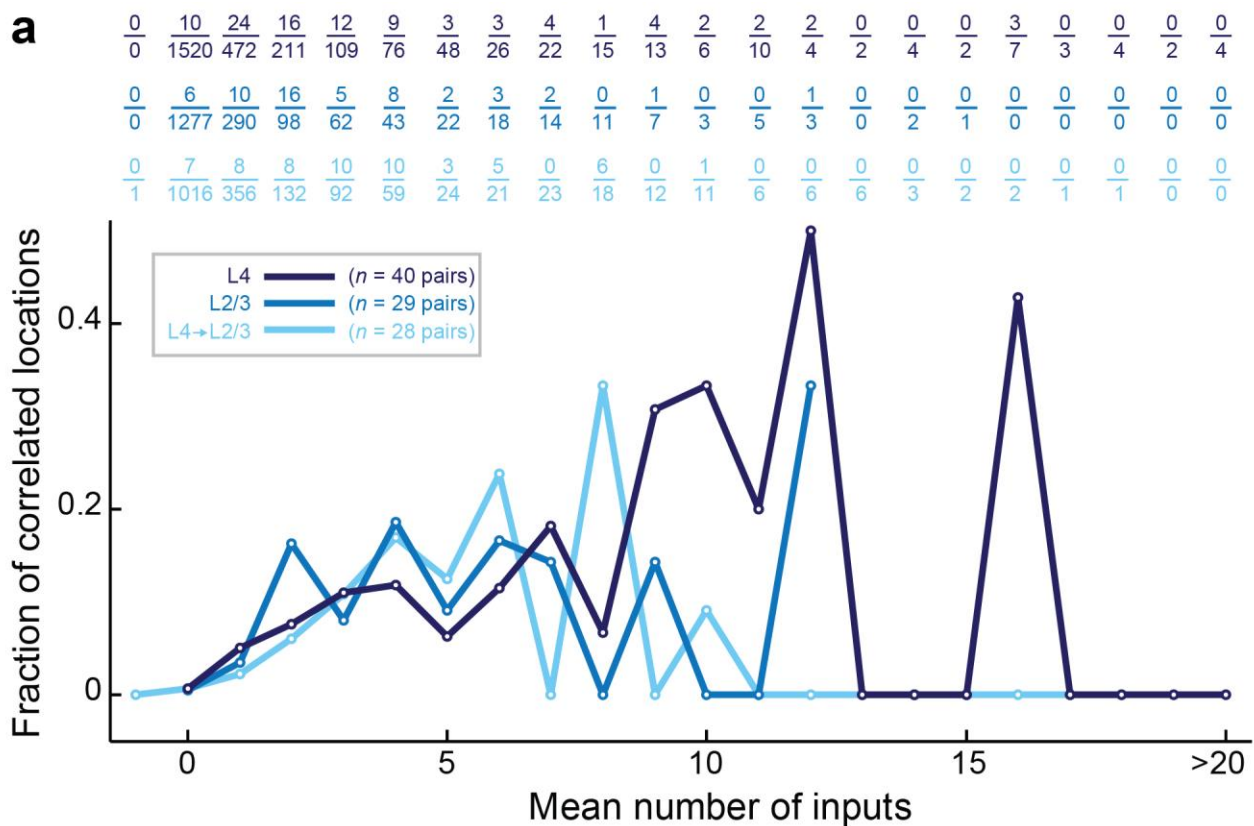
**b**

	L4	L2/3
Neurons	72	65
Number of stimulations	4608	4160
Maximum eEPSP (mean $\pm$ SD)	7.22 $\pm$ 4.53 mV	3.98 $\pm$ 2.97 mV
Spike number	0	0
Spike probability	0	0

#### Supplementary Figure 4

Photostimulation fails to evoke suprathreshold responses in V1 neurons.

(a) Example photostimulation experiment in current-clamp showing subthreshold membrane potential depolarizations evoked at each location for a pair of neurons (circles). (b) Summary table for depolarizations recorded in current-clamp from L2/3 and L4 neurons.



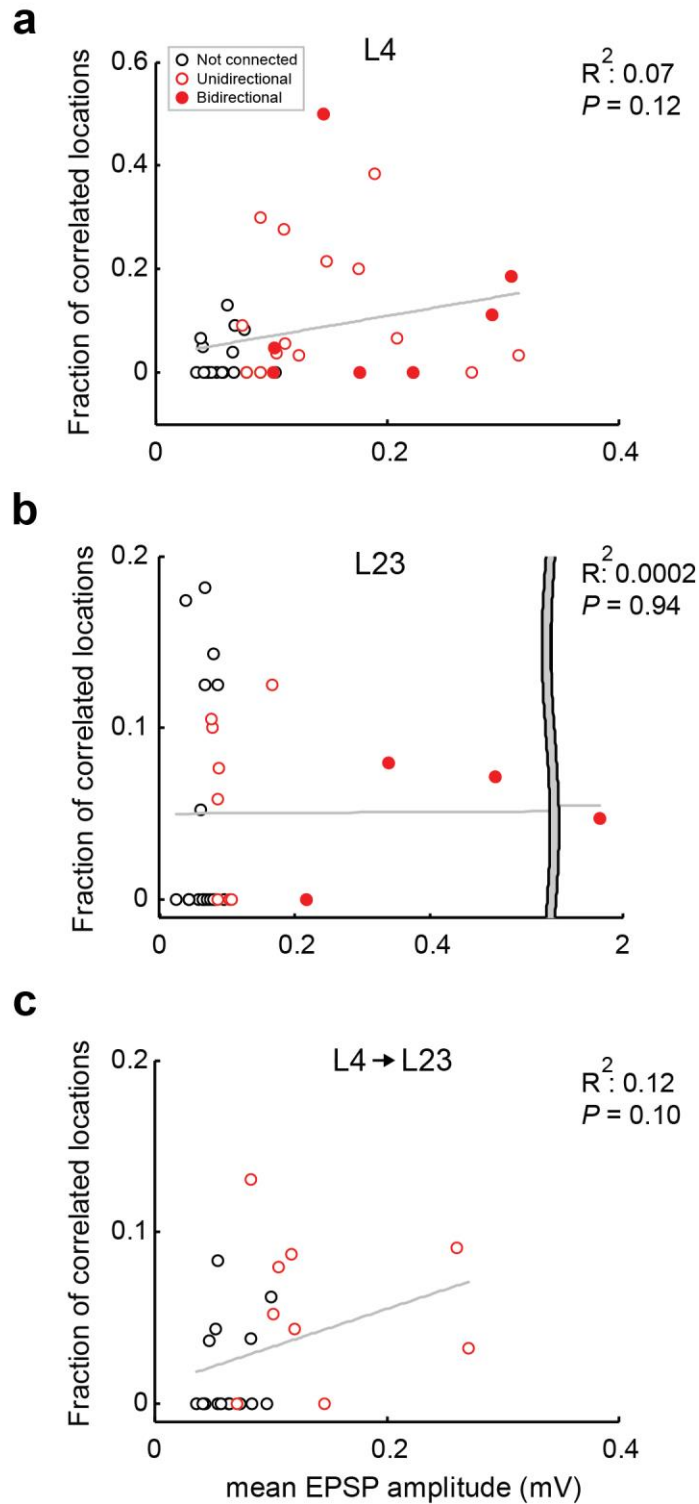
**Supplementary Figure 5**

The fraction of correlated locations increases with the number of recruited inputs.

(a) Fraction of locations with correlated inputs as a function of the mean number of inputs recruited from all photostimulated locations and all the pairs in L4, L2/3 or L4→L2/3 (connected and not connected pairs pooled together). Bin size 1 input. Exact fraction of correlated locations in each bin

are shown for L4, L2/3 and L4→L2/3 pairs. First 4 bins are the same data as in **Fig. 4 b, e** and **Fig. 5 d**. **(b)** Mean number of inputs versus distance of the photostimulated locations to each L4 pair (center of both somata). Bin size, 100  $\mu\text{m}$ . The number of locations in each bin is shown. **(c)** Fraction of correlated locations as function of distance to the pair for all L4 pairs. Bin size, 100  $\mu\text{m}$ . The fraction of correlated locations in each bin is shown. The number of inputs recruited is larger in perisomatic areas resulting in a larger fraction of correlated locations close to the somata in L4 pairs.

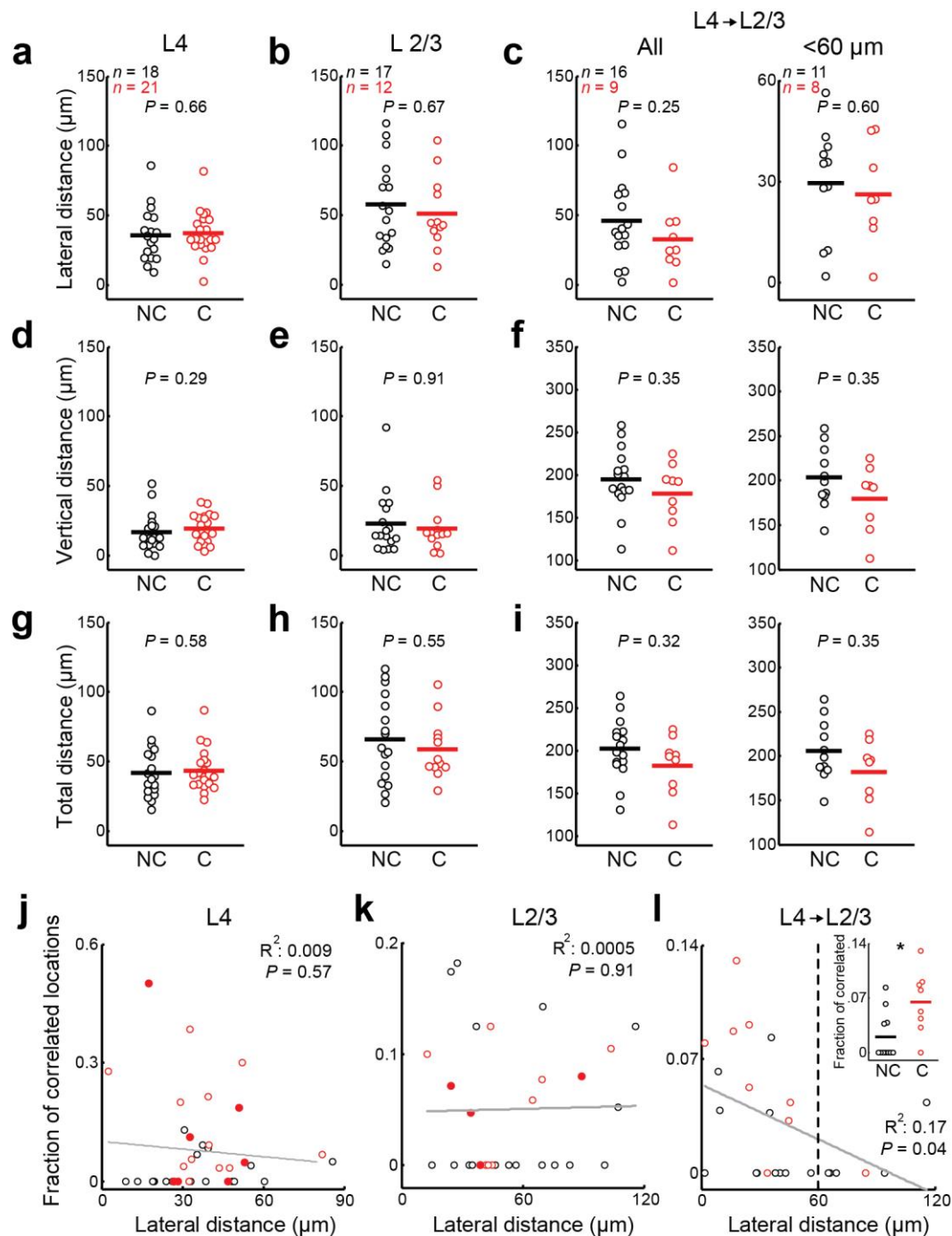




**Supplementary Figure 6**

Connection strength is a weak predictor of shared input.

Relationship between the fraction of correlated locations and the connection strength for L4 (**a**), L2/3 (**b**) and L4→L2/3 (**c**) pairs. Gray line, linear regression fit.



**Supplementary Figure 7**

Intersomatic distances of the recorded pairs.

Lateral (**a,b,c**), vertical (**d,e,f**) and total distance (**g,h,i**) for the connected and not connected pairs in each group. L4→L2/3 distances are shown for all pairs (left) or only the pairs within 60  $\mu\text{m}$  of lateral distance (right).  $P$  value for Wilcoxon rank sum test between groups is shown in each panel.

Horizontal lines, mean. (**j,k,l**) Fraction of correlated locations as function of lateral distance for L4, L2/3 and L4→L2/3 pairs. Gray line, linear regression fit. Filled dots, bidirectionally connected pairs. For L4→L2/3 pairs there was a significant effect of horizontal distance on the fraction of correlated

locations. However, as there was only one connected pair at distances  $> 60 \mu\text{m}$ , the effect could be due to connectivity and not distance. To disambiguate this we compared correlations only for pairs  $< 60 \mu\text{m}$  apart. While lateral displacement was very similar across the two groups (panel **c**, right), the fraction of correlated locations was still larger in the connected group (inset in panel **I**, fraction of correlated locations for individual vertical pairs within  $60 \mu\text{m}$  of lateral distance;  $P < 0.02$  Wilcoxon rank sum test).