1 Supplementary material

Supplementary figures and videos can be visualized as interactive .html files at https://dbbs-lab.github.io/deschepper-etal-2021/, adding e.g. "video" + number + ".html" e.g.: “videoS2.html”, on this URL.

**Figure S1 | Placement metrics.** Cell placement is assessed using various metrics for each population, including (a) Nearest Neighbor distance, (b) Pairwise Distance, (c) Radial Distribution Function. These metrics show realistic cell positioning.

![Nearest neighbour](image1)

![Pairwise distance](image2)

![Radial distribution function](image3)

**Figure S2 | Connecting SC-PC by voxel intersection.** A mesh of adjacent voxels is used to enwrap the axon of a stellate cell (50 cubes with 4.6 µm side) and the dendritic tree of a PC (50 cubes with 26 µm side). The intersecting voxels are in red. The synapses are located on compartments within the intersecting voxels.
Figure S3 | Coupling graph for GoCs. Each of the 70 blue dots represents a GoC in the horizontal plane. The grey edges represent connections through gap junctions.

Figure S4 | MLI responses to mf burst. (a) Multiple linear regression of SCs and BCs in responses to the mf burst against the number of synaptic spikes from pf/s and from other SCs or BCs. (b) One SC and one BC crossed by an active pf beam are represented in 3D. The GABAergic synapses from other SCs or BCs are also indicated. Bigger markers correspond to presynaptic GrCs more activated by the mf burst. In this example, the SC receives 8% and the BC 7.5% of their pf synapses from GrCs with at least 2 active dendrites.
Table S1 | Input-output dependency of model neurons. Multiple linear regression between neuronal responses (firing rates) to the mf burst and the number of incoming spikes from the presynaptic neurons (during 40 ms from the mf burst onset), averaged over 10 simulations. $R^2$ and direction coefficients are reported.

|      | $R^2$ | Coefficient |
|------|-------|-------------|
| GrC  | 0.91  | 6           |
|      |       | -0.55       |
| GoC  | 0.81  | 0.14        |
|      |       | 0.15        |
|      |       | -0.006      |
| PC   | 0.95  | 0.057       |
|      |       | 0.091       |
|      |       | 0.074       |
|      |       | -0.2        |
| SC   | 0.79  | 0.54        |
|      |       | -0.018      |
| BC   | 0.72  | 0.11        |
|      |       | -0.017      |

Table S2 | Passive properties of the neuron models. Membrane capacitance $C_m$; Axial resistance $R_a$; Leakage conductance $G_L$; Passive conductance for myelinization $P_{as}$; Reversal potential for leakage $E_L$. They were based, if the data was available, on experimental data and adapted during the single cell fitting procedure. The Pas channel was used only in PCs to simulate the myelin sheath. The values for $GrC$, $GoC$ and $SC$ are the same published in the respective papers. $GrC$, $GoC$ and $SC$ are the same published in the respective papers. The values for the PC were adapted to mice morphologies and, as such, are slightly different compared to $109$. The mouse BC and PC models are not published yet. The following links contain the passive and active (ionic and synaptic) properties and their distribution for each model:

- [https://github.com/dbbs-lab/models/blob/master/dbbs_models/granule_cell_models.py](https://github.com/dbbs-lab/models/blob/master/dbbs_models/granule_cell_models.py)
• https://github.com/dbbs-lab/models/blob/master/dbbs_models/golgi_cell_models.py
• https://github.com/dbbs-lab/models/blob/master/dbbs_models/purkinje_cell_models.py
• https://github.com/dbbs-lab/models/blob/master/dbbs_models/basket_cell_models.py
• https://github.com/dbbs-lab/models/blob/master/dbbs_models/stellate_cell_models.py

|     | Cm [µF/cm²] | Rs [Ω cm] | G_L [S/cm²] | Pas [S/cm²] | E_L [mV] |
|-----|-------------|-----------|-------------|-------------|----------|
| GrC | 1 - 2.5     | 100       | 3.53e-07 - 0.00029 | -           | -60      |
| GoC | 1 - 2.5     | 122       | 1e-06 - 3e-05    | -           | -55      |
| PC  | 1 - 6       | 122       | 0.0003 - 0.001   | 5.6e-09     | -61      |
| BC  | 1           | 122       | 3e-05           | -           | -60      |
| SC  | 1 - 1.5     | 110       | 8e-06 - 3e-05    | -           | -48      |