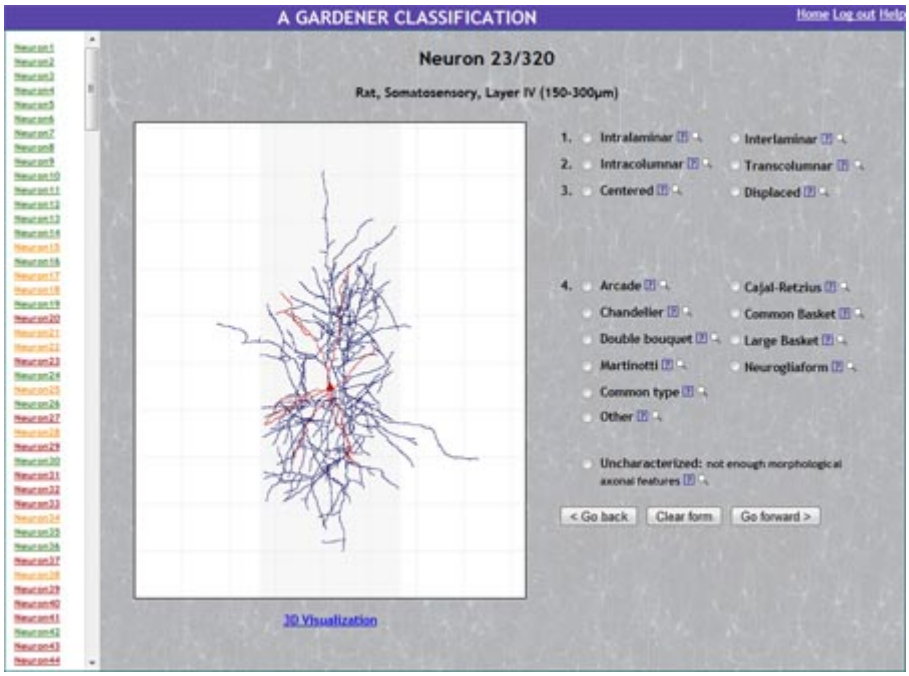
Neuron Classification



In this page you can set the classification for a neuron.

On the top of the page, some information about the neuron is given: species, cortex region, layer and the approximate thickness of the layer.

On the left there is a picture of the neuron. You can see the picture fullsized by clicking on it. Axons are painted in blue and dendritic arbors are shown in red. Grid lines are established every 100µm. A cortical column of approximately 300µm centered on the soma is presented (shade).

You can also see the 3D morphology of the neuron by clicking the link "3D Visualization". Go to the visualization help section to read about how to use this feature.

To classify the neuron you have to click the radio buttons ( ) on the right. A neuron classification is only complete when you have specified a class in each of the levels proposed. Click on the help button (?) next to each class to see a description and a diagram. Click on the search button (🔍) next to each class to see other neurons classified with that class (see Search section).

When you have finished classifying a neuron, you can go to the next unclassified one by pressing the "Go forward >" button. You can go to any neuron by clicking on the links list on the left (your classification will be saved either way).

The "Log out" link on the top-right corner will also save your changes and take you to the Log in page.

Neuron classes description

The 320 interneurons included in the experiment have been obtained directly from various laboratories and from the URL http://neuromorpho.org (see reference list). These interneurons include examples from different areas and layers of the cerebral cortex of the mouse, rat, rabbit, cat, monkey, and human (this information is shown on the top of each page, along with an estimation of the thickness of the corresponding layer). To help classification, a grey grid is shown for each drawing. The spacing between the grid lines is 100 µm. A light grey vertical band is shown representing a cortical column (300 µm). Additionally, most of them offer a 3D visualization.

The morphological features to be considered for the experiment are defined as follows:

Box 1

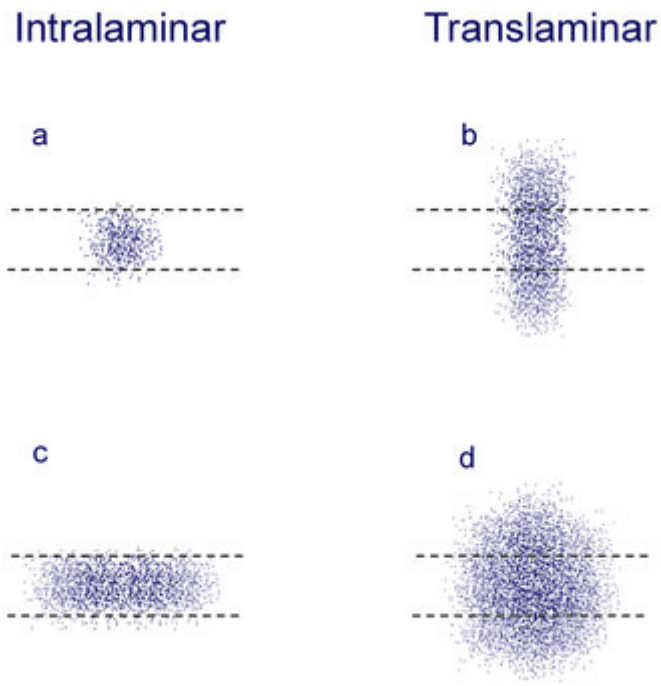
Refers to the distribution of the axonal arborization of interneurons relative to cortical layers. Within this group, the following terms are proposed (**Fig. 1**):

Intralaminar:

Refers to interneurons with axonal arborizations distributed locally, near the parent cell body, predominantly in the same layer of the parent soma (Figure 1 a, c). That is the distribution of the axonal arborization remains within the thickness of the corresponding layer (this information is shown on the top of each page).

Translaminar:

Refers to interneurons with axonal arborizations distributed mainly above and/or below of the cortical layer of the parent soma (Figure 1 b, d). That is the distribution of the axonal arborization exceeds the thickness of the corresponding layer (this information is shown on the top of each page).
Figure 1



Box 2

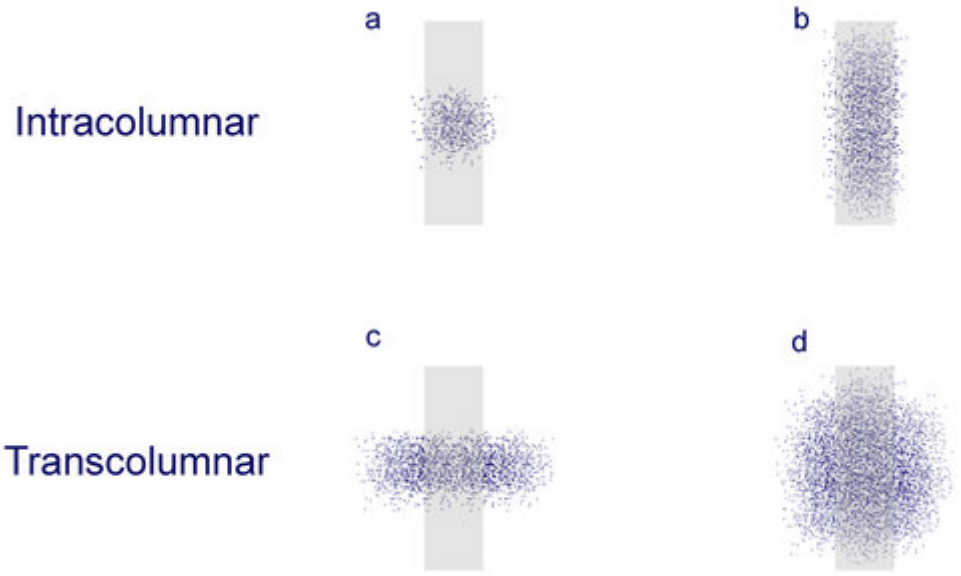
Refers to the horizontal distribution of the axonal arborization. We have considered the thickness of 300µm to define the diameter of the hypothetical cortical column (Malach, 1994; Mountcastle, 1998). Within this group, the following terms are proposed (**Fig. 2**):

Intracolumnar:

Refers to interneurons with axonal arborizations distributed near the parent cell body, at a distance from the parent soma that does not exceeds 300µm in the horizontal dimension (a light grey vertical band is shown representing a cortical column; Figure 2 a, b).

Transcolumnar:

Refers to interneurons with axonal arborizations distributed near the cell body, but with prominent horizontally running axonal collaterals. These collaterals exceed the width of the column (300µm) in the horizontal dimension from the soma (a light grey vertical band is shown representing a cortical column; Figure 2 c, d).
Figure 2



Box 3

Refers to the relative location of the axonal and dendritic arborizations. Within this group, the following terms are proposed:

Centered:

Refers to interneurons whose dendrititc arbor is located mostly in the center of the axonal arborization (Fig. 3).

Displaced:

Refers to interneurons whose dendrititc arbor is shifted with respect to the axonal arborization (Fig. 4). The red dots in this figure indicate possible locations of the cell body of the neuron. Additionally, for translaminar neurons the following subdivisions can be distinguished:

Ascending:

Refers to interneurons whose axonal arborization is distributed mostly towards the cortical surface.

Descending:

Refers to interneurons whose axonal arborization is distributed mostly towards the white matter.

Both:

Refers to interneurons whose axonal arborization is distributed towards both, the cortical surface and the white matter.

Figure 3

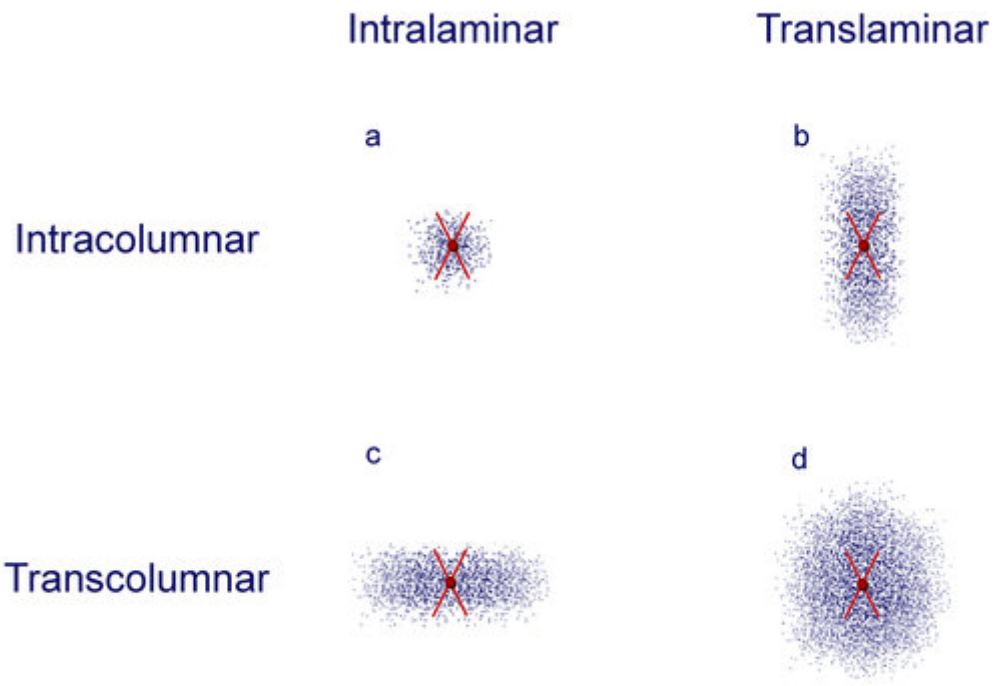
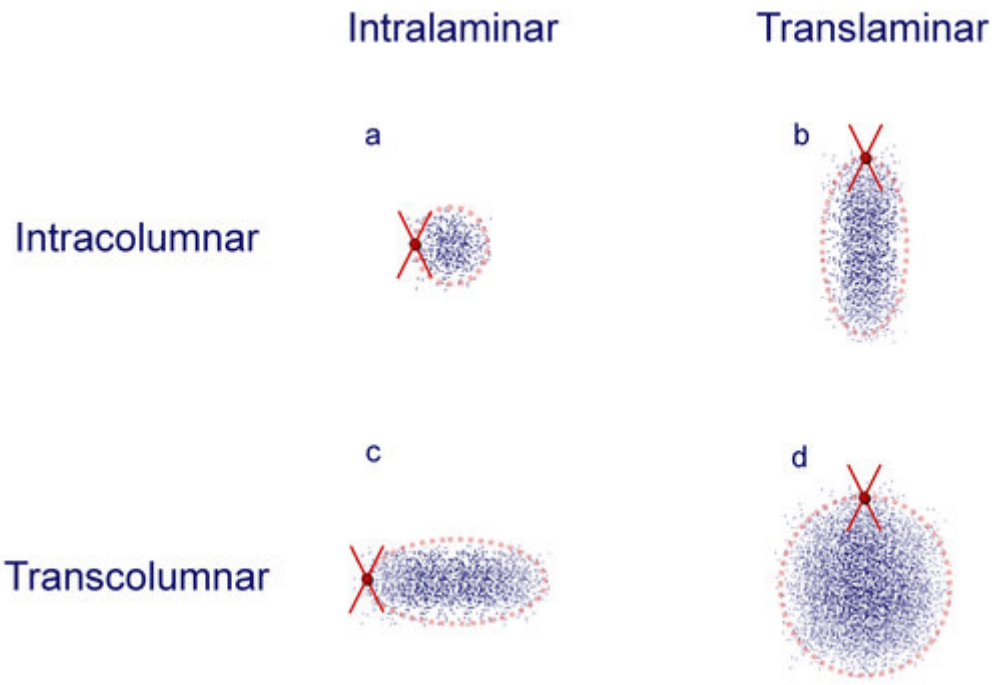


Figure 4

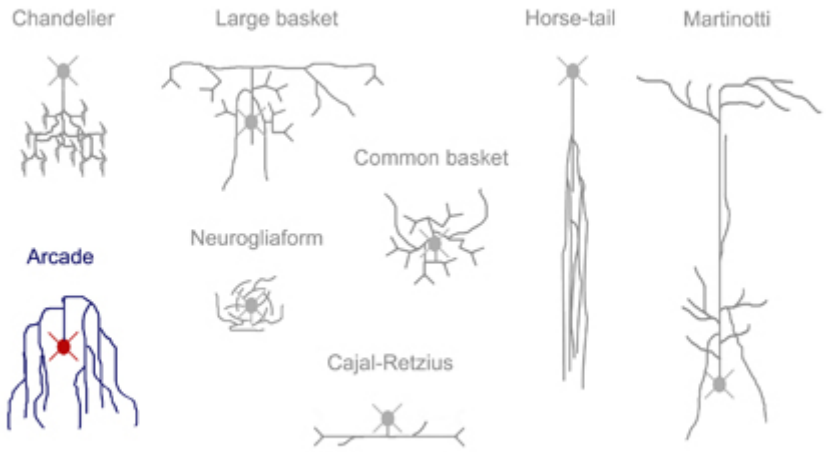


Box 4

Refers to specific terms that involve particular morphological characteristics of the axonal arborization. Within this group, the following names are proposed:

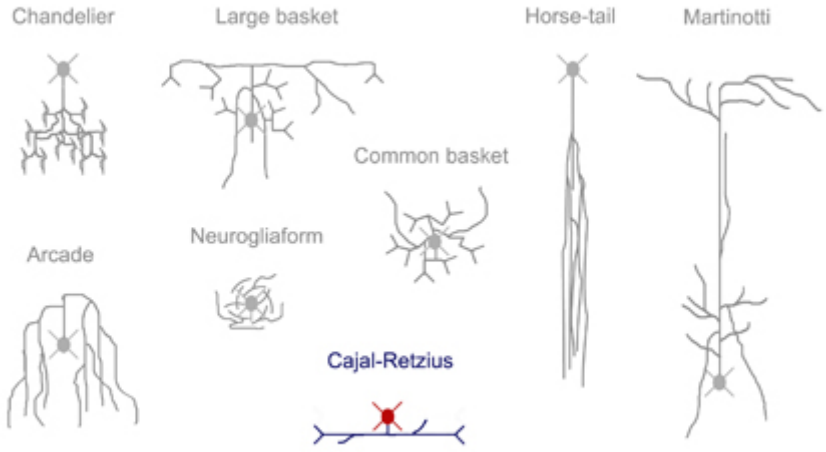
Arcade:

Neurons with soma mostly found in layers II-IV; multipolar or bitufted dendrites; and axons giving rise to axonal arcades, with predominantly vertical arborizations and relatively long descending collaterals.



Cajal-Retzius:

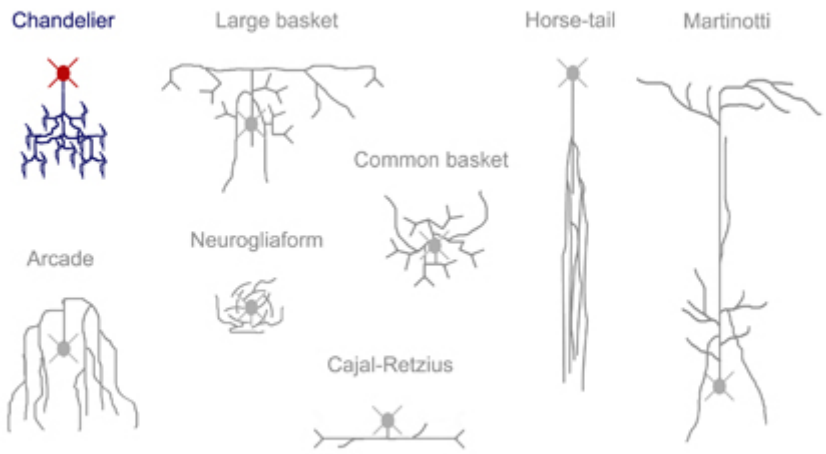
Neurons with an axon plexus restricted to layer I and long dendrites with ascending branchlets to the pia. These neurons are not present in adult brain (in rodents, they persist only during the two first postnatal weeks).



Chandelier:

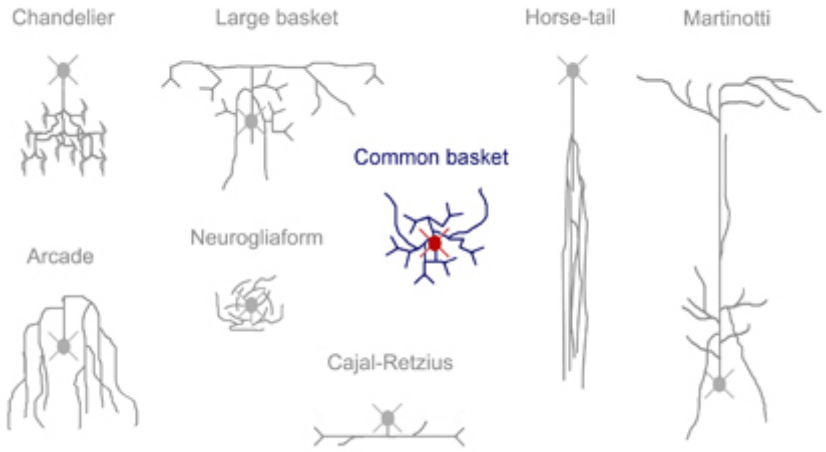
Neurons with soma in layers II-VI; multipolar or bitufted dendritic arbors; and distinguished by pre-terminal axon branches that form short vertical rows of boutons

resembling candlesticks.



Common Basket:

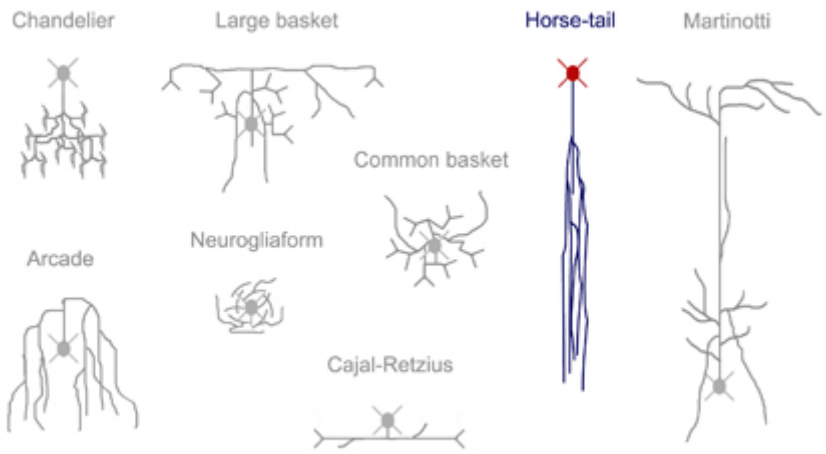
Neurons with soma in layers II-VI; multipolar or bitufted dendritic arbors; and axon collaterals with numerous curved pre-terminal axon branches.



Horse-tail:

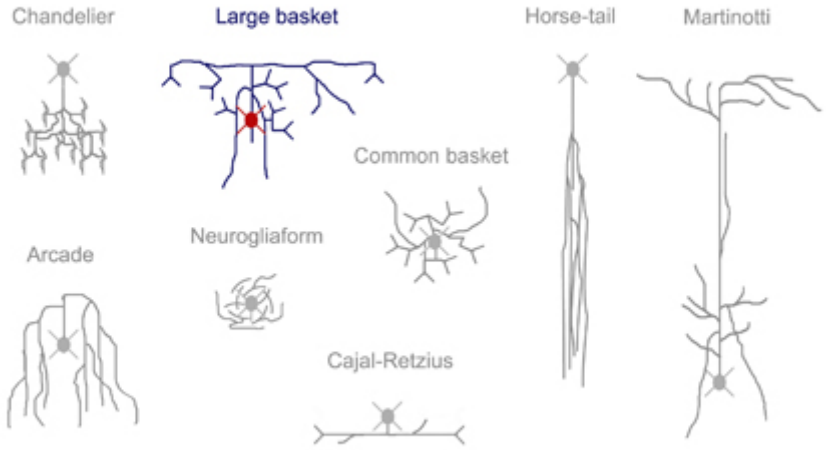
Neurons with soma in layers II-III; multipolar or bitufted dendrites; and distinguished by their "horse-tail" axons forming tightly intertwined bundles of long descending

vertical collaterals.



Large Basket:

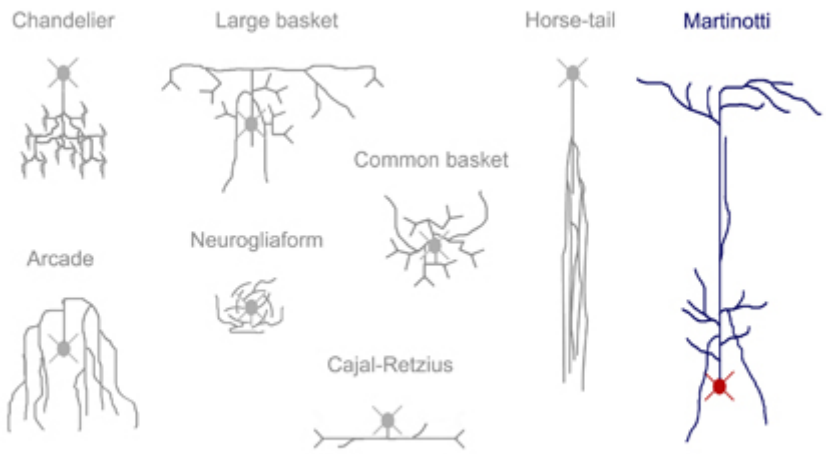
Neurons with soma in layers III-VI; multipolar or bitufted dendritic arbors; and horizontally oriented axon collaterals with numerous curved pre-terminal axon branches that can reach a length of several hundred microns.



Martinotti:

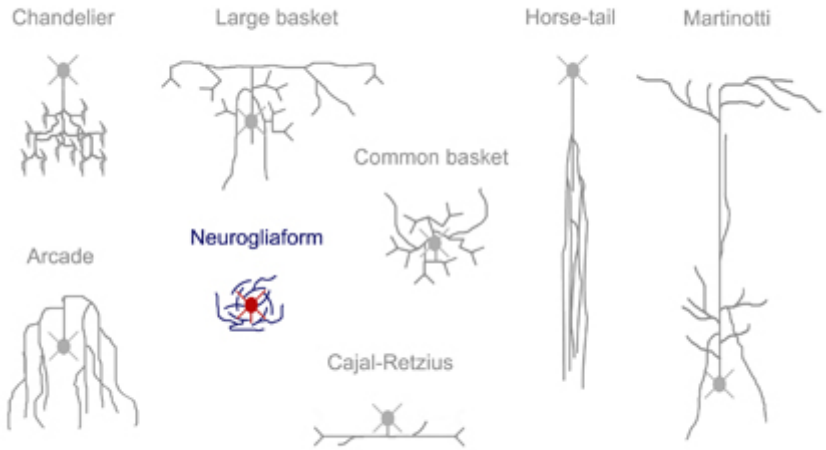
Neurons with soma in layers III-VI; multipolar, bitufted or bipolar dendrites; and distinguished by their ascending axons that give rise to two axonal arborizations, one near the cell body and the other at a variable distance above the cell body. This second plexus may be very dense (axonal tuft) or more diffuse, and it can be found either in the same cortical layer as the cell body of origin or in the layers above (ascending axons can

travel from layer VI to layer I).



Neurogliaform:

Neurons with soma in layers II-VI; multipolar dendritic arbors; and characterized by very small, local axonal arborization around the parent cell body.



Common type:

Neurons with soma in layers I-VI; multipolar, bipolar or bitufted dendritic arbors; and axon collaterals that do not exhibit any apparent preference.

Other:

This option is to label the neuron with an alternative name in case the experimentalist considers more suitable another term.

Uncharacterized:

When not enough morphological axonal features of a given interneuron are visualized. In other words, the axon needs to be labeled more extensively in order to identify the neuronal type.