Starter Guides: ABC Atlas - Single-Cell & Spatial Transcriptomics Mouse Datasets, *Tool User Manual*

This modified user manual for ABC Atlas, pulled from "ABC Atlas User Guide" to provide more context.

The ABC Atlas aims to empower researchers worldwide to explore and analyze multiple whole-brain datasets simultaneously. As the Allen Institute and its collaborators continue to add new modalities, species, and insights to the ABC Atlas, this groundbreaking platform will keep growing, opening up endless possibilities for groundbreaking discoveries and breakthroughs in neuroscience. With the ABC Atlas, researchers

everywhere can gain new insights into the brain's complex workings, advancing our understanding of this amazing organ in ways we never thought possible.

Top Tips

- Recommend using Chrome Browser
- 1 point/dot on the tool represents 1 cell. Point's size and shape is not indicative of cell's actual size or shape
- Sharing your URL will allow the person to see what you see with all features pre-filtered.
- Visualization of co-expression of genes is not possible within the ABC Atlas tool. You can access the data via the Jupyter Notebooks
- When you have multiple datasets viewed, filters will only apply to the highlighted view
- Links to the list of all genes available for each dataset found on this resource, along with other helpful sources: https://portal.brain-map.org/help-and-community/guide-cell-types#How_to_use_ABC_Atlas

Tool Overview

- The icon panel on the left allows quick navigation between Control Panel tabs. The filters and settings on each tab all work together to change what is displayed in the visualization frames to the right.

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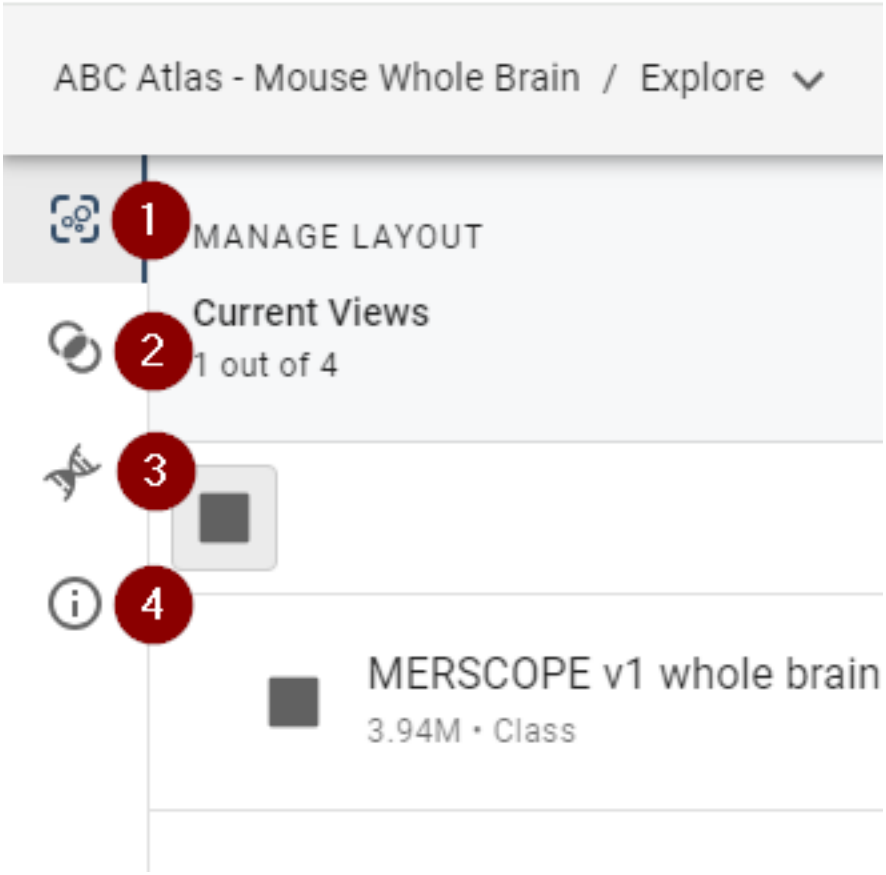
There are four tabs, each controlling a different aspect of the visualizations:

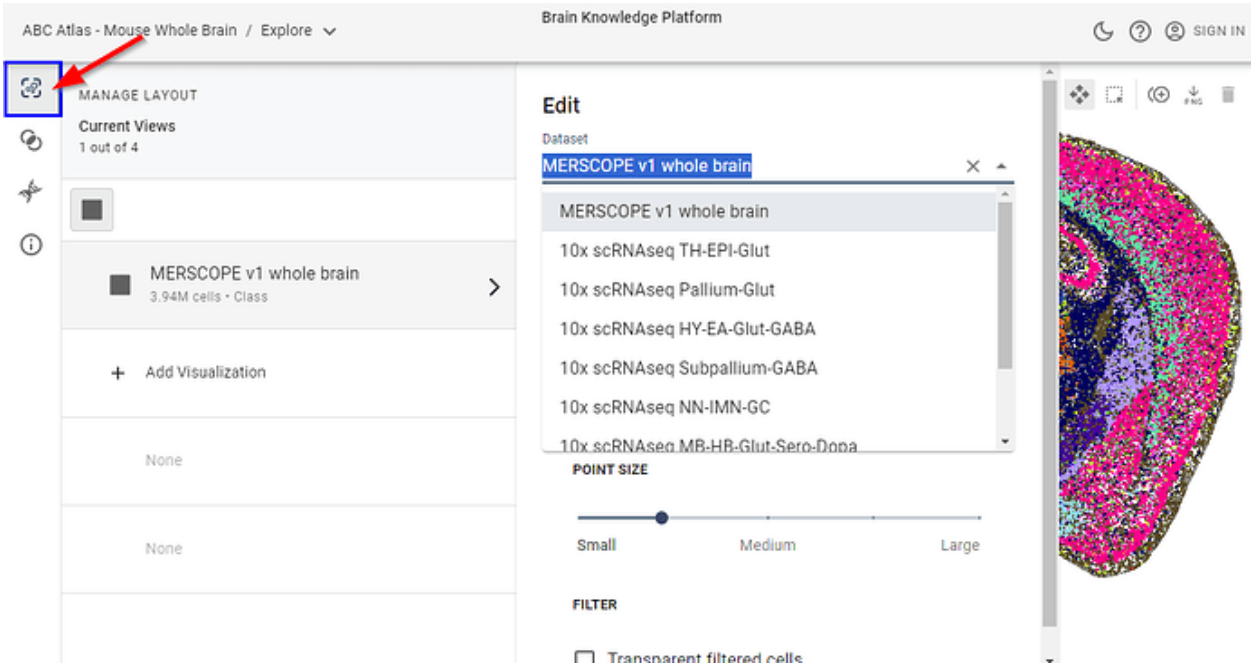
1. Manage Layouts - Find data to add to your view or change your layout
2. Cell Properties - Filter and color by data features and values. Properties like sex, cell type, and anatomical location can be found here.

3. Genes - Search, select, and color by gene expression
4. About - Learn more about the selected data set including download links



Manage Layouts & Browse Data Sets

The Manage Layout tab allows adding, changing, and reordering visualization frames. “Visualization” in this context refers to datasets. Overview of difference between the ABC Atlas dataset review this document in “Datasets in ABC Atlas” section. Settings like point size and transparency can also be accessed here.



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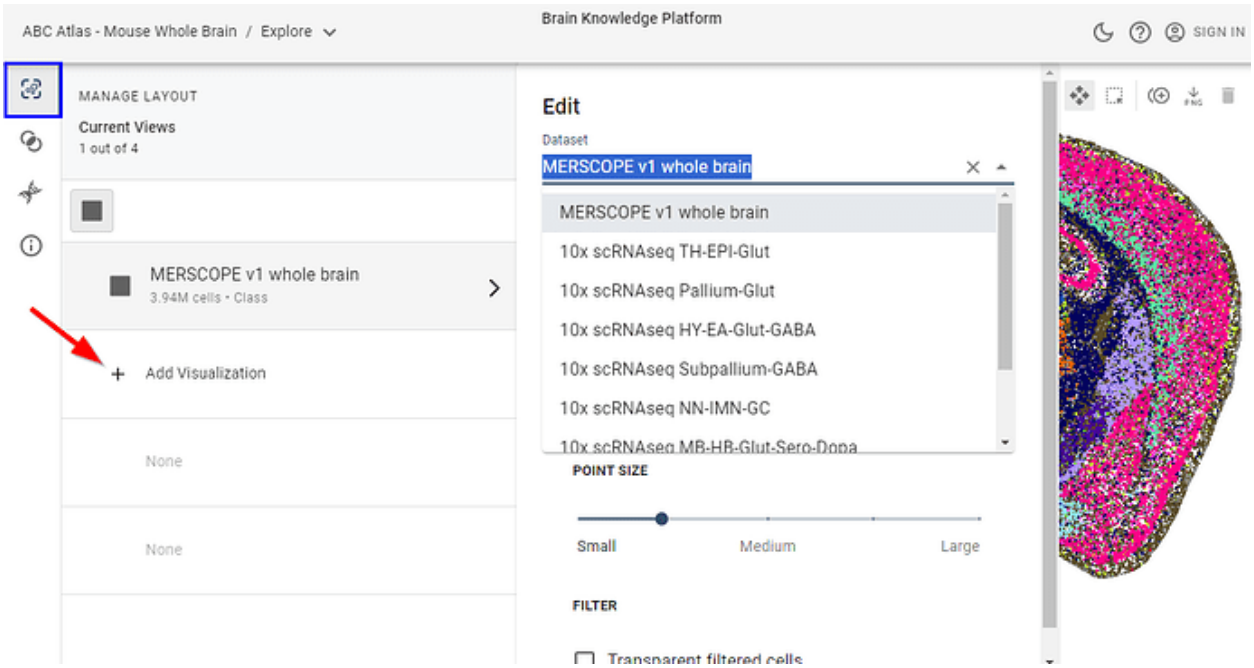
Adding and changing views

- To add a new visualization, click the + icon in an open row. This allows you to view the same or different dataset(s) side-by-side for easy comparison.



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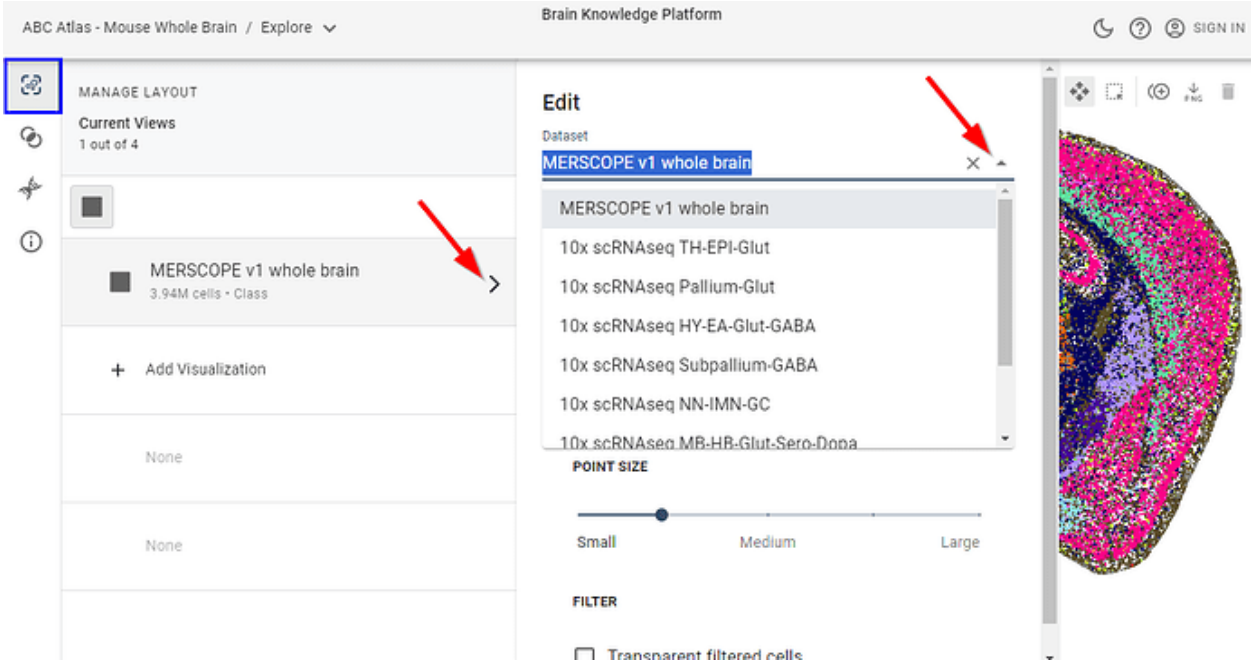
- When adding or changing a view, the data set can be selected using the dropdown list in the pop-out menu
- The layout orientation can be changed by clicking the icons at the top of the panel. Change the order of views by dragging and dropping a row in the list.



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Settings

Resolution/Performance

The balance between resolution quality and rendering speed may be adjusted using the

Resolution/Performance slider in the Settings tab. In order to dynamically render the millions of points in our data sets, we use a sophisticated sampling algorithm that trades off speed for resolution when zoomed out. Depending on system setup, the data being viewed, and exploration goals, the slider may be used to increase speed and reduce resolution or vice versa.

The same setting may produce different results with different data sets or different system setups. We encourage you to experiment with the settings to find the one that works best for your needs

Please note:

Your device, internet connection, browser, and other factors can influence performance and loading speed. For best results, we recommend using the ABC Atlas in an updated version of the Chrome browser and closing unnecessary programs and browser tabs. If you experience significant performance issues, please let us know using the feedback survey and include your system details.

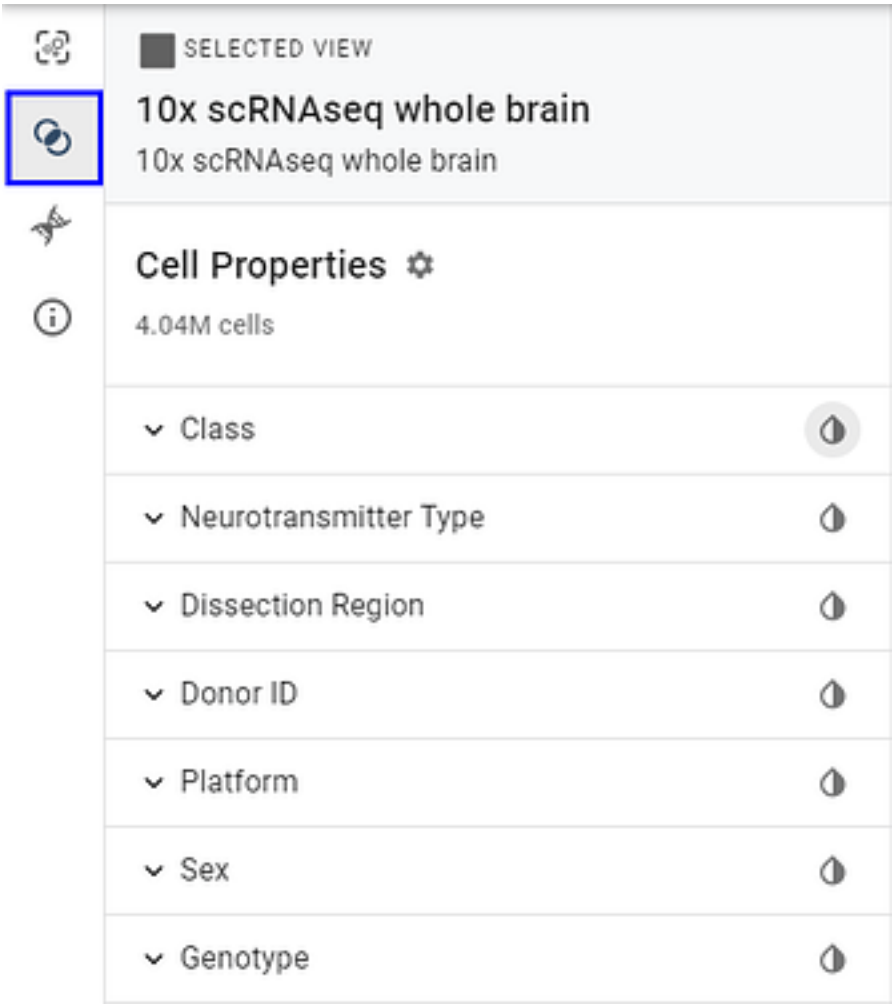
Point Size

Each point represents one cell. The point's size or shape doesn't reflect the actual cell's size or shape. The point size can change in the Settings tab to help you more easily see the size. Move the Point Size slider to the left for smaller points (for less overlap) or to the right for larger points (for denser visualizations). Points will dynamically resize as you zoom in or out relative to the size selected.

Transparency

- If a filter has been applied to your visualization, you may adjust the prominence of the unselected cells.
- To change transparency, navigate to the Settings tab within the Control Panel and click the checkbox and adjust the slider to change the opacity.
- Setting the transparency to the lowest level will remove the unselected cells completely.

Cell Properties



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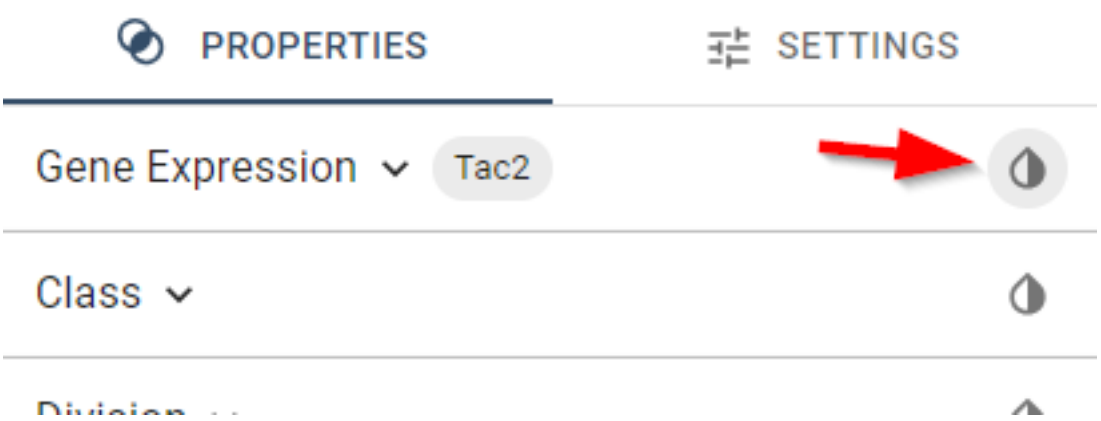
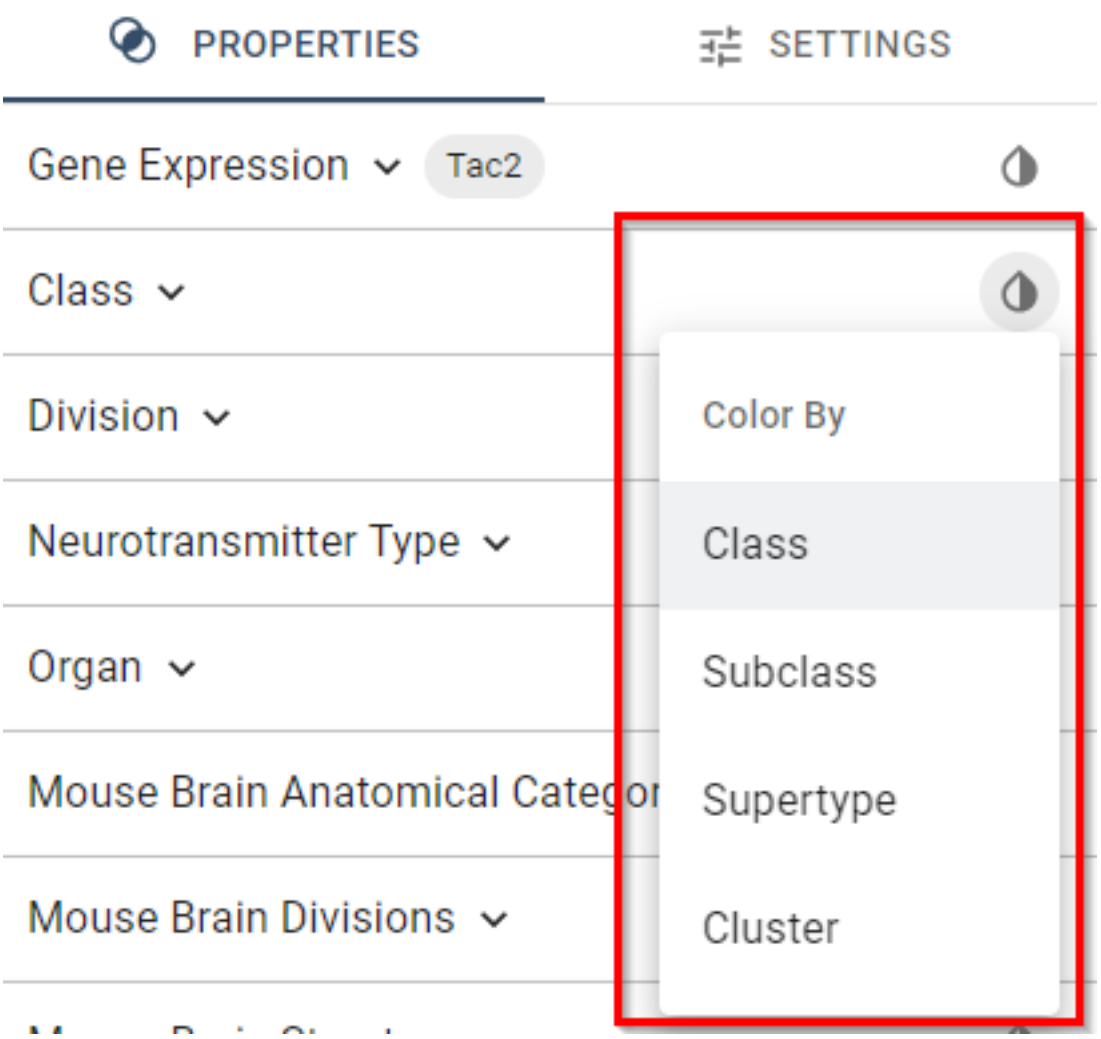
Color

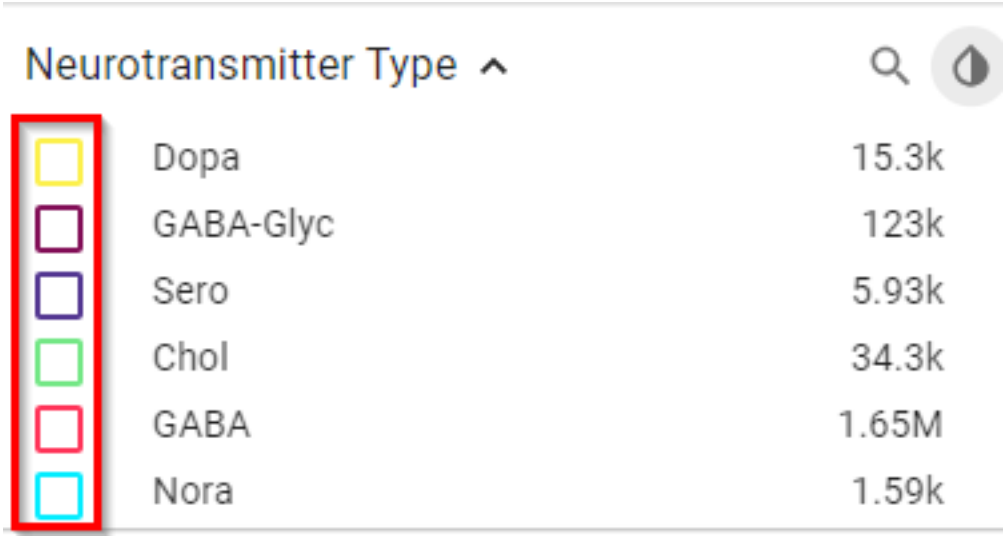
- You may apply color to your visualizations to help distinguish cells within a category or gene expression.
- Color values are predetermined and may only be applied to one feature at a time.
- Click the droplet icon to the right of a feature to color by that feature. The currently colored feature is indicated by a gray circle highlighting its droplet.



- For hierarchically nested features, click the droplet to display a dropdown menu with additional coloring options.



- If color has been selected for a feature, the checkbox next to its sub-values will change to reflect each value's corresponding color in the active frame.



When you color by a feature, values under the other features show the distribution of cells in the next lower level of the hierarchy as a horizontal bar next to that value. When a filter is applied, only the selected values(s) will display this bar.

Filtering

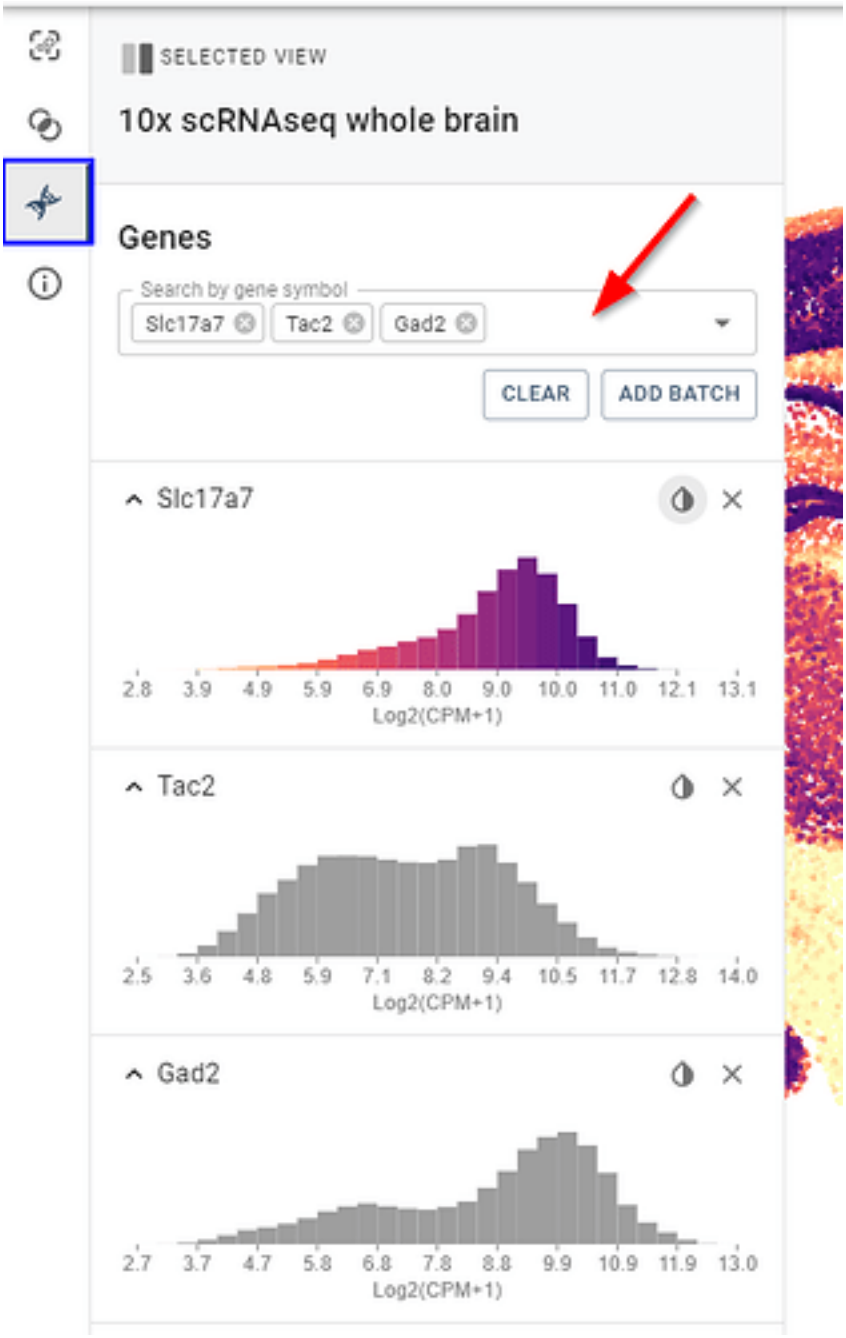
- Color may be applied to a subset of cells in the visualization using filters.
- Multiple filter selections within a feature will include any cells that meet either criterion (OR), while multiple filter selections across features will only display cells meeting all criteria (AND).
- When no filters are selected, the total number of applicable cells appears next each value within a feature. Once a filter has been applied, only the selected values will show cell counts, other unselected values will display zero.
- To filter cells from your active frame, check the box next to a value you wish to see colored. Cells with any other value within the feature will be grayed out. See notes on Transparency to adjust the opacity of these filtered-out cells.

- When filters have been applied, a gray badge appears at the top of the feature section indicating the number of active filters. To remove all selected filters, click the “x” in the gray badge.

Genes

On the Genes tab, search and select multiple genes in the search bar or use the Add Batch button to add a list of genes all at once.

- Links to the list of all genes available for each dataset found on this resource: https://portal.brain-map.org/help-and-community/guide-cell-types#How_to_use_ABC_Atlas



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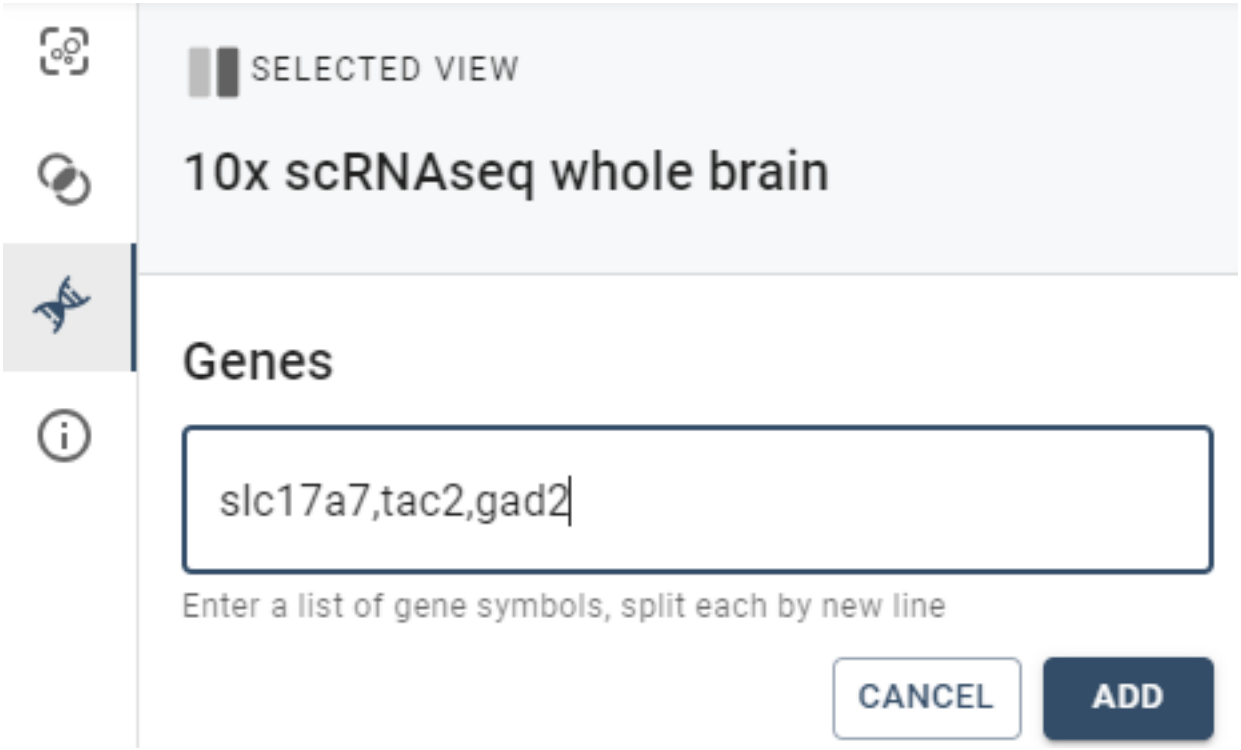
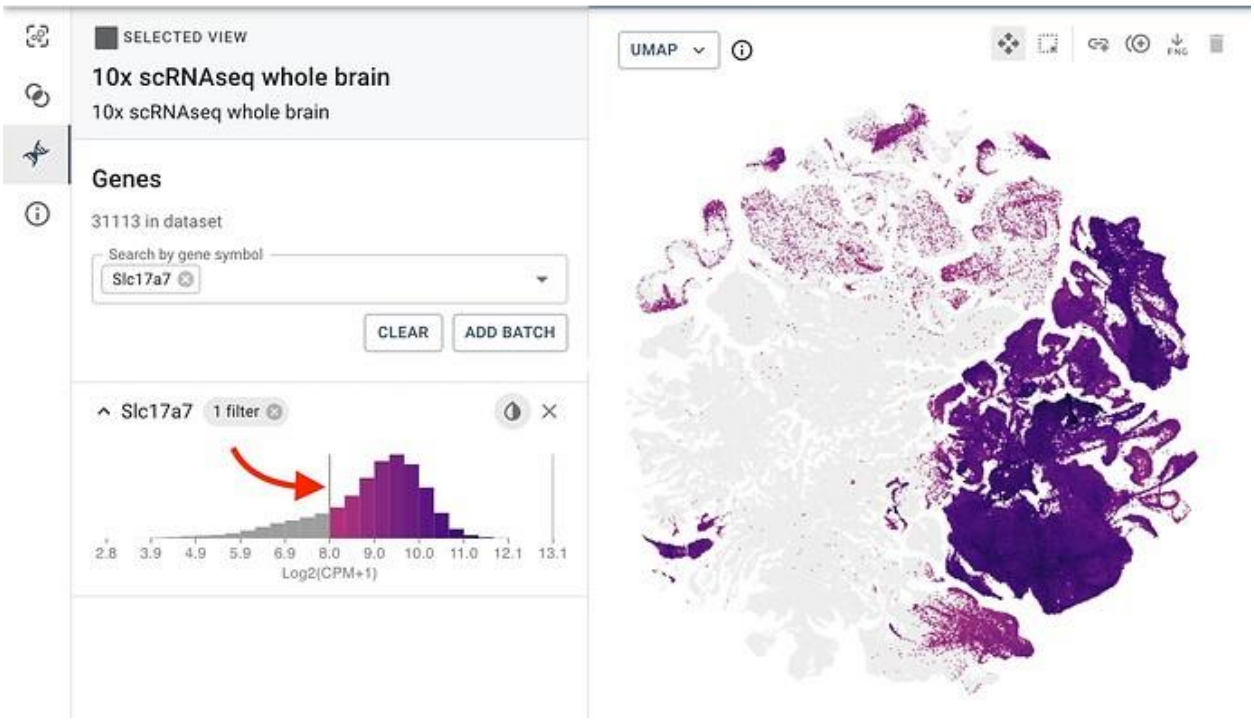


Please note that each view may only be colored by one gene at a time. To see multiple genes, create additional views or toggle between genes using the color droplet icon.
If you want to see multiple genes expression amount, you must access the data via the ABC Atlas Jupyter Notebooks.

Gene Expression Filtering

To filter views by gene expression value, from the Genes tab, after selecting a gene, click on the gene name to show the expression histogram. Click anywhere in the histogram to initiate filtering, then click and drag the vertical bars to adjust the values shown in your filter.



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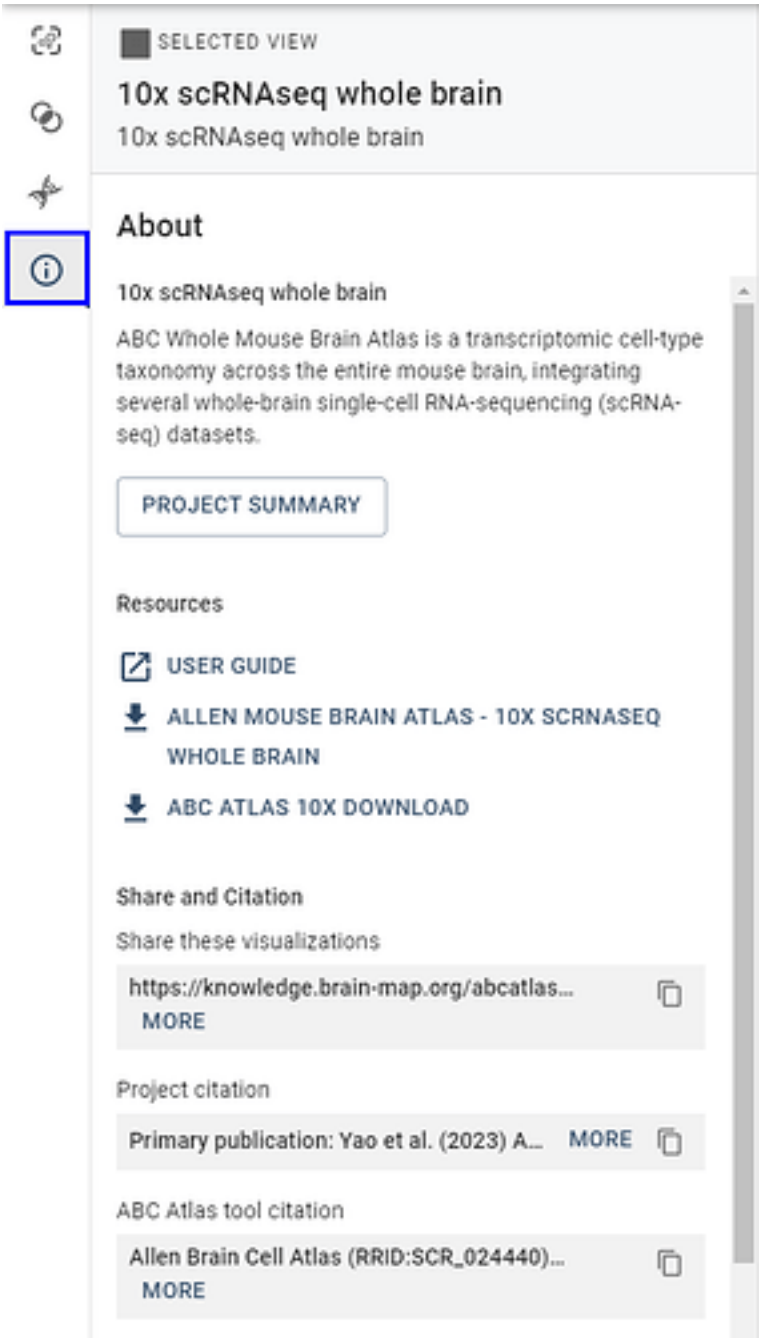
Tip: You can filter by gene expression values while coloring by a different feature, including other genes.

Citing, Sharing & More Information



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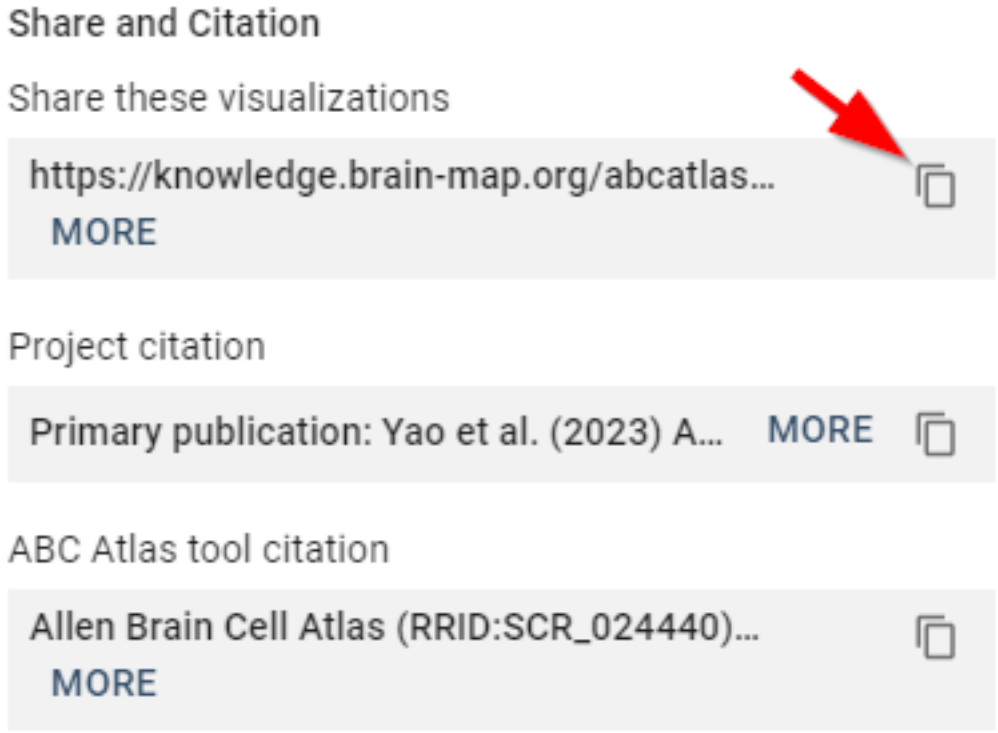
In the About tab, learn more about the selected data set including download links, sharing, and citation tools.

Share and Citation

It is now easier than ever to save, share, and cite data from the ABC Atlas. In the About tab, under the Share and Citation heading, there are three options.

Share

Click the copy icon to copy a link to the current set of visualizations. The link saves the state of all views including, filters, colors, and camera positions and can be shared with others or saved for future reference.

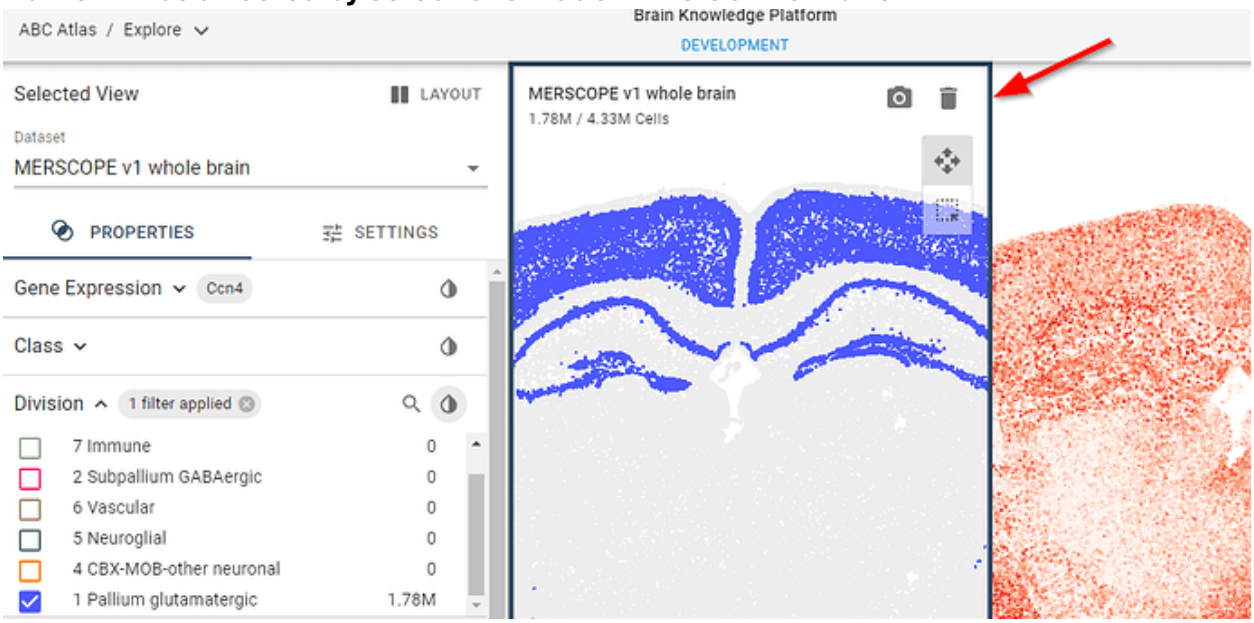


Project Citation & ABC Atlas Tool Citation

To view citations for the data being viewed (project citation) or the ABC Atlas (tool citation), click the more link. Click the copy icon to copy the text of the citation to the clipboard for easy pasting.

Visualization Frame

The ABC Atlas allows you to view up to four visualizations at the same time. When viewing multiple visualizations, the active frame is indicated by a bold outline. **Only the active frame will be affected by selections made in the Control Panel.**



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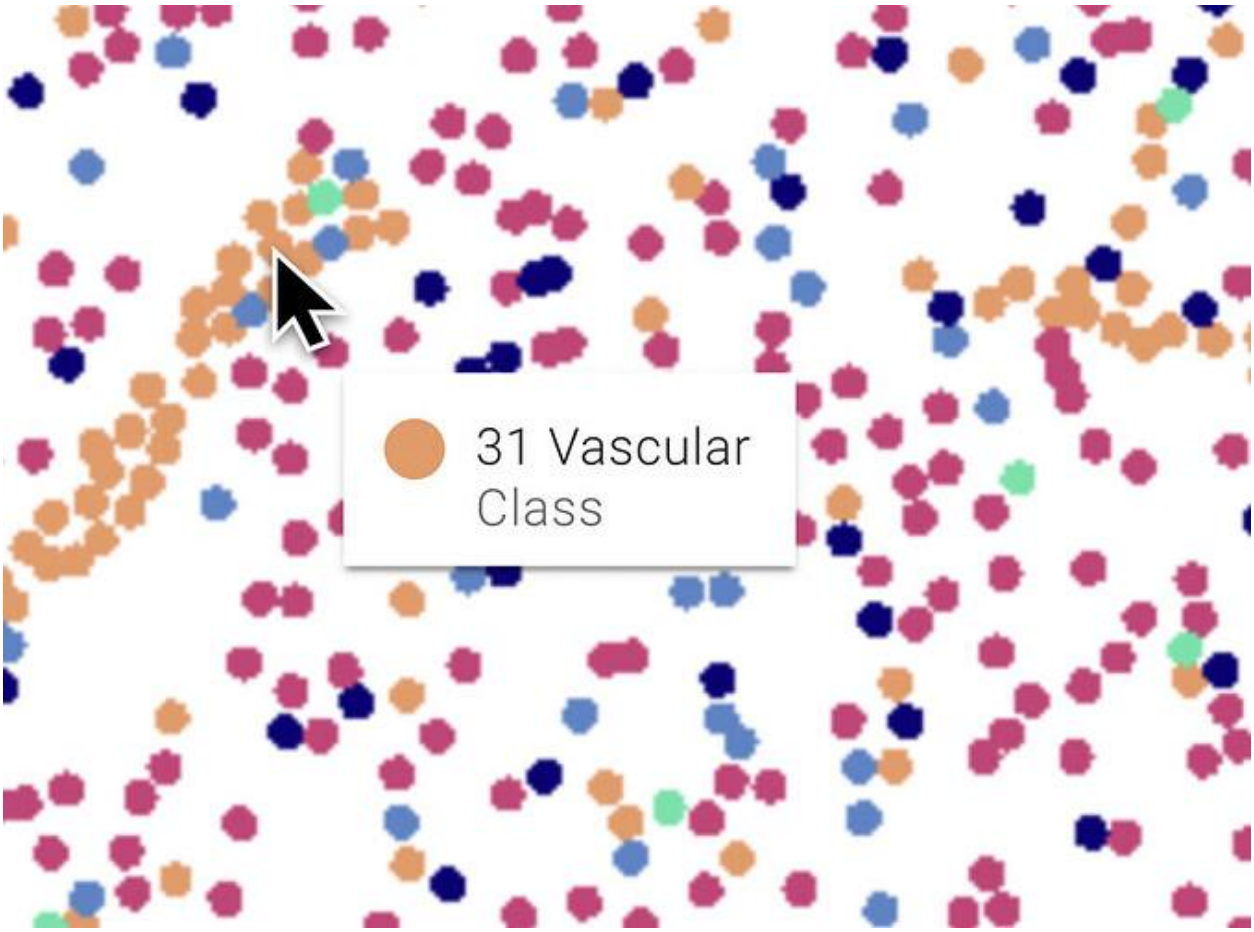
Tool tips

While in Zoom and Pan mode, hovering your mouse over a cell will display details of the cell's color. For example, if your visualization is colored by Class, hovering over a cell will show which class the cell belongs to. If multiple cells overlap, the most common cell in the area will be shown.



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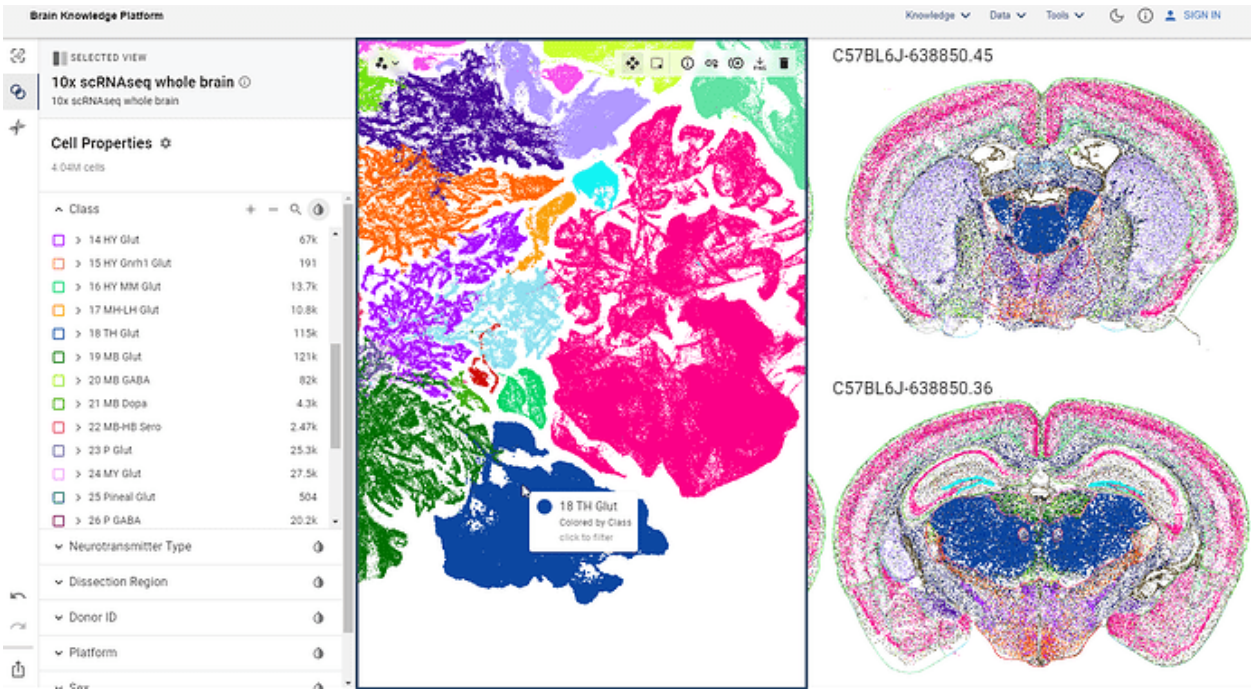
Hover Sync

When hovering over a cell in addition to the cell property displayed in the tool tip, other cells in the view temporarily increase in size to show where else that value occurs. If other views are open with cells that share that value, those cells will also temporarily increase in size.

For example, when viewing the Zeng and Zhuang whole mouse brain data sets side by side and coloring by cell type in both views, hovering over a cell type in one view will highlight the same value in the other view.

This same cross-view highlighting can also be achieved by hovering over a value in the cell properties left tool bar.



Duplicate View

In the top right of the selected view, clicking the third icon from the left will create a new view with the same colors, filters, pan, and zoom settings as the active view

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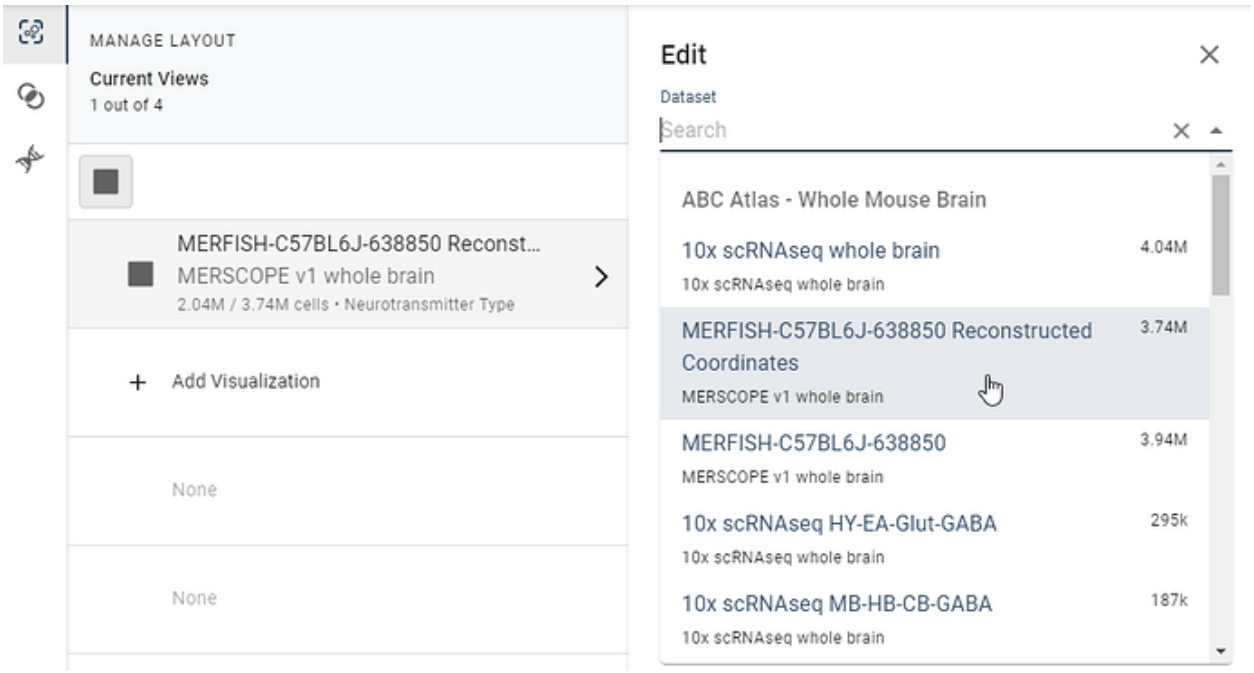
Anatomical Annotations

You can view spatial data with anatomical annotations. To view the anatomical annotations, select the MERFISH-C57BL6J-638850 Reconstructed Coordinates dataset from Manage Layout Add Visualization menu.



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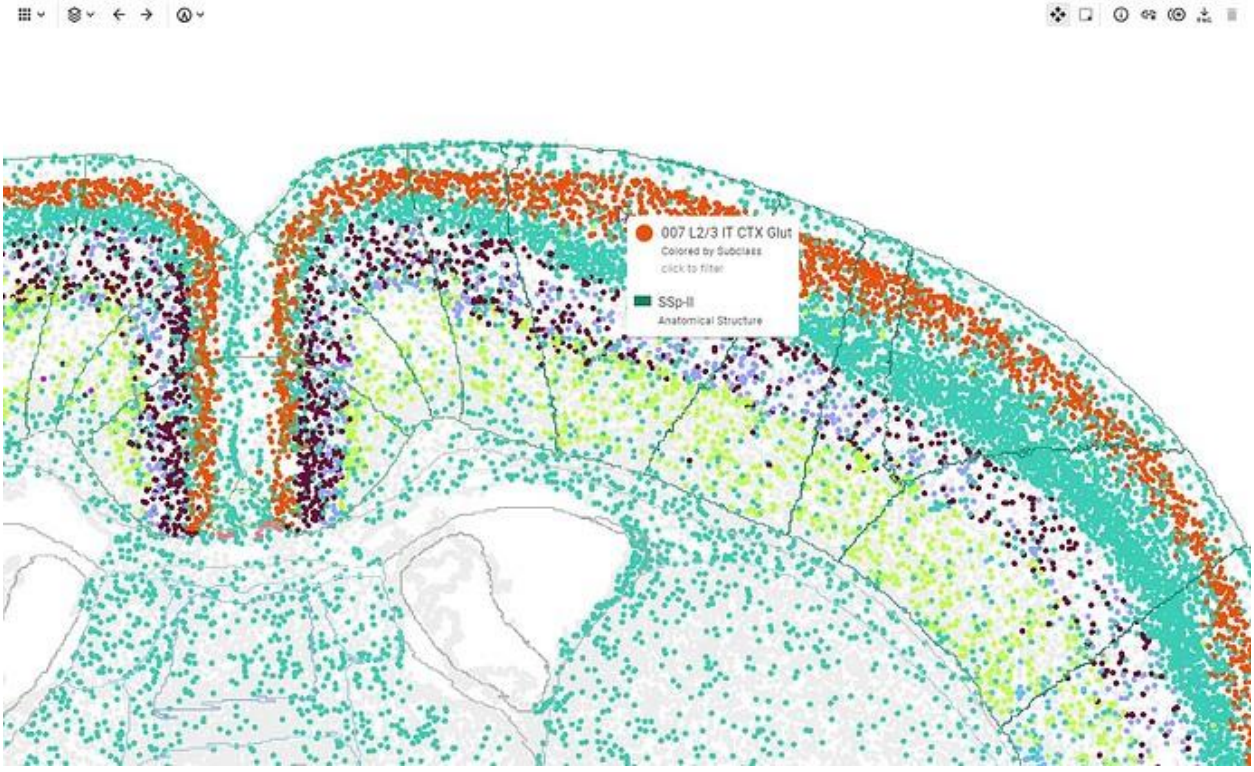
Annotation tool tips

When hovering over a cell, the anatomical annotation for that region will also be displayed.



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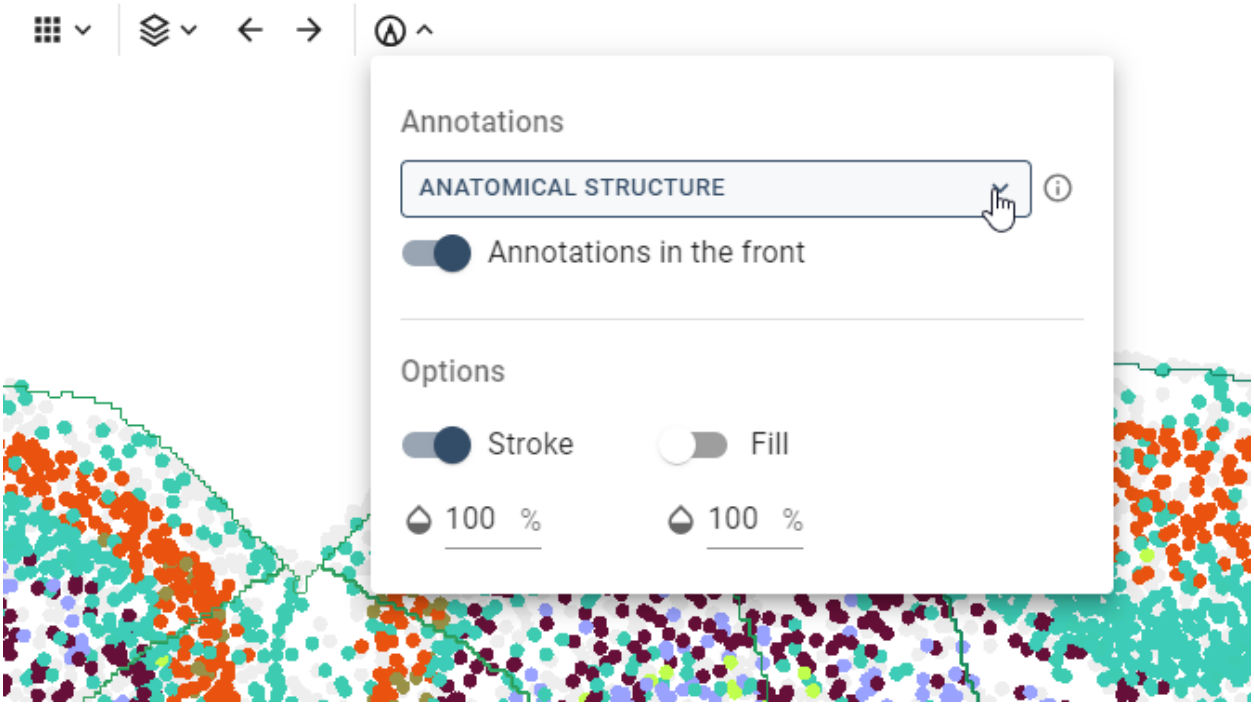
Annotation controls

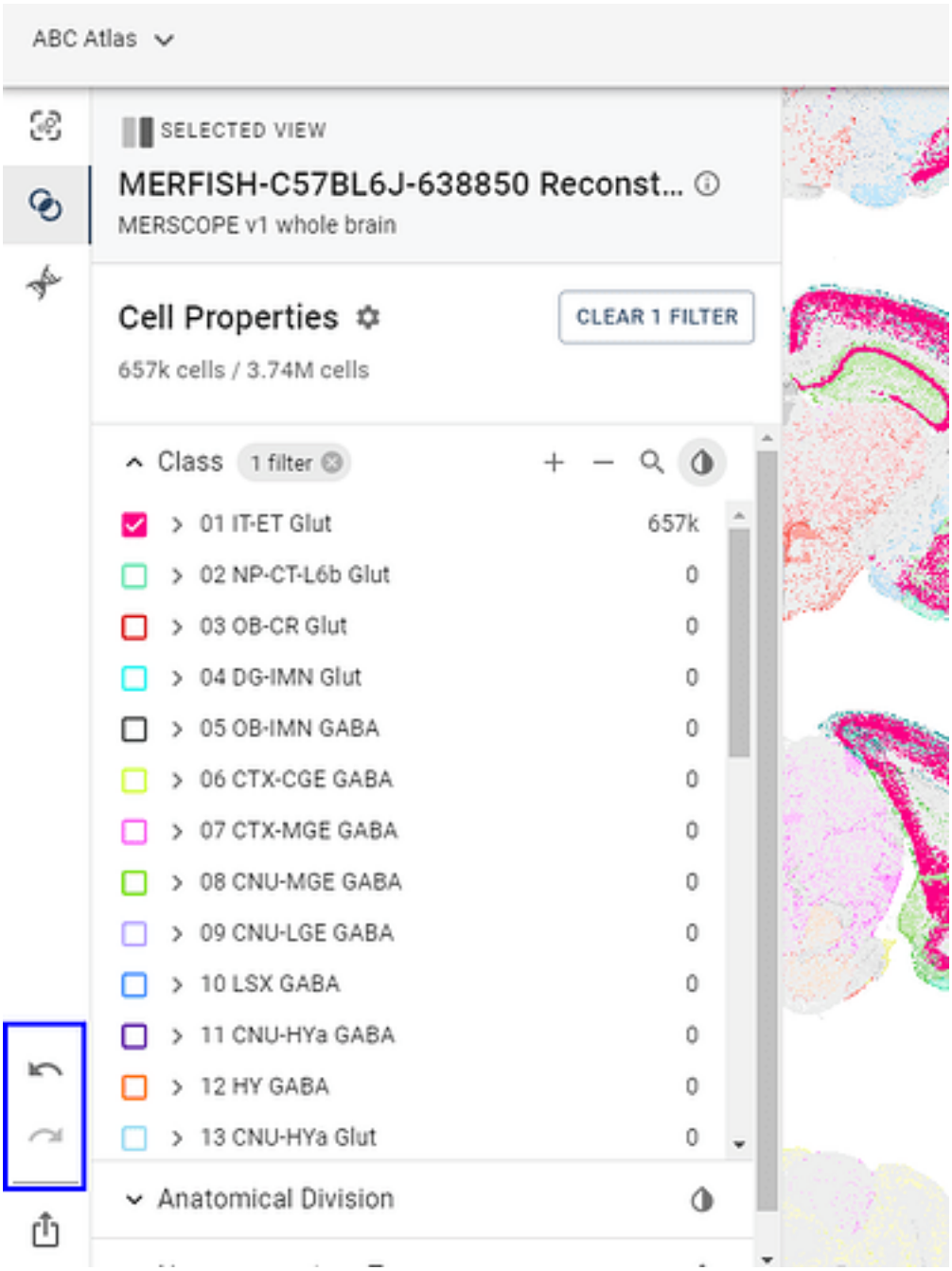
For datasets that support anatomical annotations, a new pen icon will be available in the top left of the view. Click this icon to manage annotation settings

- Change the granularity level of the regions using the drop down menu.
- Select whether the annotations appear as an overlay (in front) or and underlay (behind) the cell dots.
- There are two display options for annotations which can be used separately or together.
    - Stroke will display outlines of the anatomical regions
    - Fill will show a solid color in each region.
- The transparency of both the outlines and the fill can also be changed by specifying an opacity percentage next to the droplet.
- The (i) icon shows additional information about the annotation data (e.g. version numbers), if available.



Undo and Redo

Actions taken to change views can now be reversed. Actions include applying filters, adding or removing views, changing pan and zoom camera positioning, and more. To undo previous actions, click the back arrow in the bottom of the left-most navigation panel. Once an action has been undone, it can be redone by clicking the forward arrow.



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Download image

This creates a high-resolution PNG image of the selected view and initiates the download through your browser.

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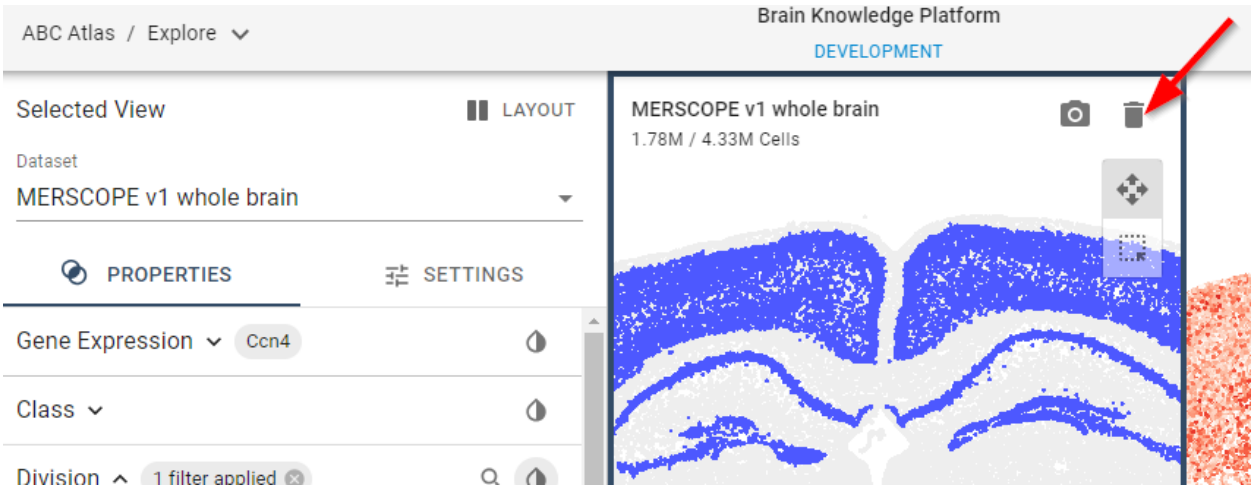
Trashcan

Click the trash can icon in the upper right of the active frame to remove it from your layout.



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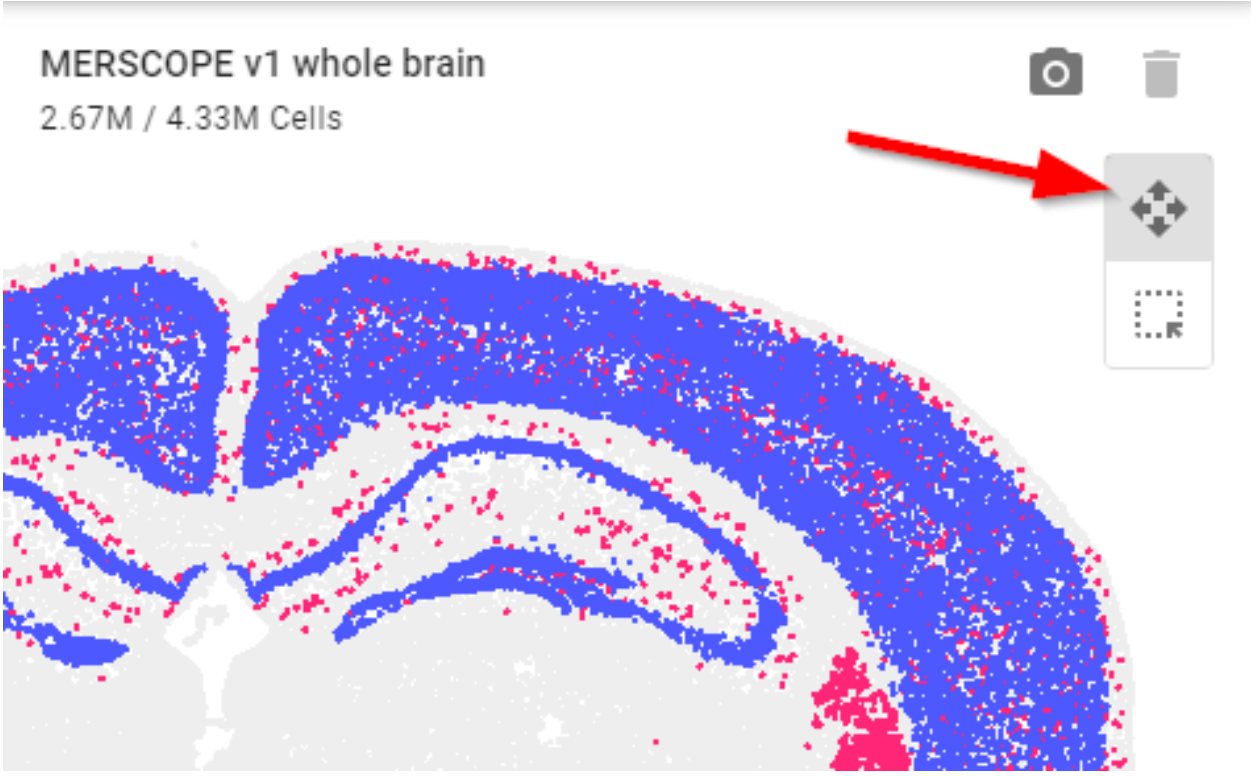
Navigation modes

- ABC Atlas allows two navigation modes, Zoom & Pan or Cell Selection. The active navigation mode is indicated by and can be changed using the icons in the top right of the active frame. Only one navigation mode is active at a time.
- Zoom & Pan is indicated by four arrows and Cell Selection is indicated by the perforated square.



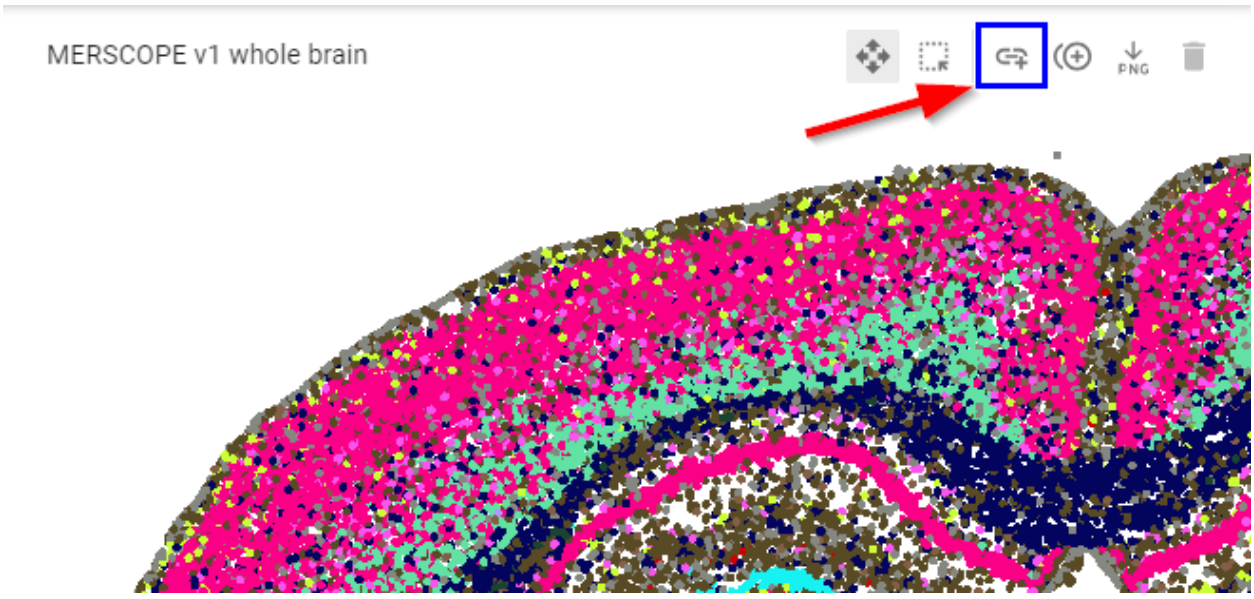
Zoom & Pan

- Use your mouse scroll wheel to zoom in to view more detail or out to see more of the visualization at once.
- Click and drag to view a different area of the visualization.

Zoom & Pan View Syncing

Zoom & Pan Syncing creates spatial sync groups between views of the same data set, allowing you to control two or more views at once. When syncing is enabled, as you zoom in or move the “camera” in one view, synced views will follow, maintaining the same position. Syncing does not affect selected filters or colors so that you can compare different features in each view.

- To initiate Zoom and Pan Syncing click the link icon in the top right of the selected view. Note: If syncing is enabled in only one view, this will not change the behavior of the selected view.



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- Click the link icon in a second view of the same data to link the two views. Now any change made to the zoom or pan state in one view will also be reflected in the other view. Enabling syncing for additional views of the same data will add them to the original sync group.
  Note: Only one sync group per data set is supported.
- Click the link icon again to remove a view from the sync group and allow the camera for that view to be controlled independently.

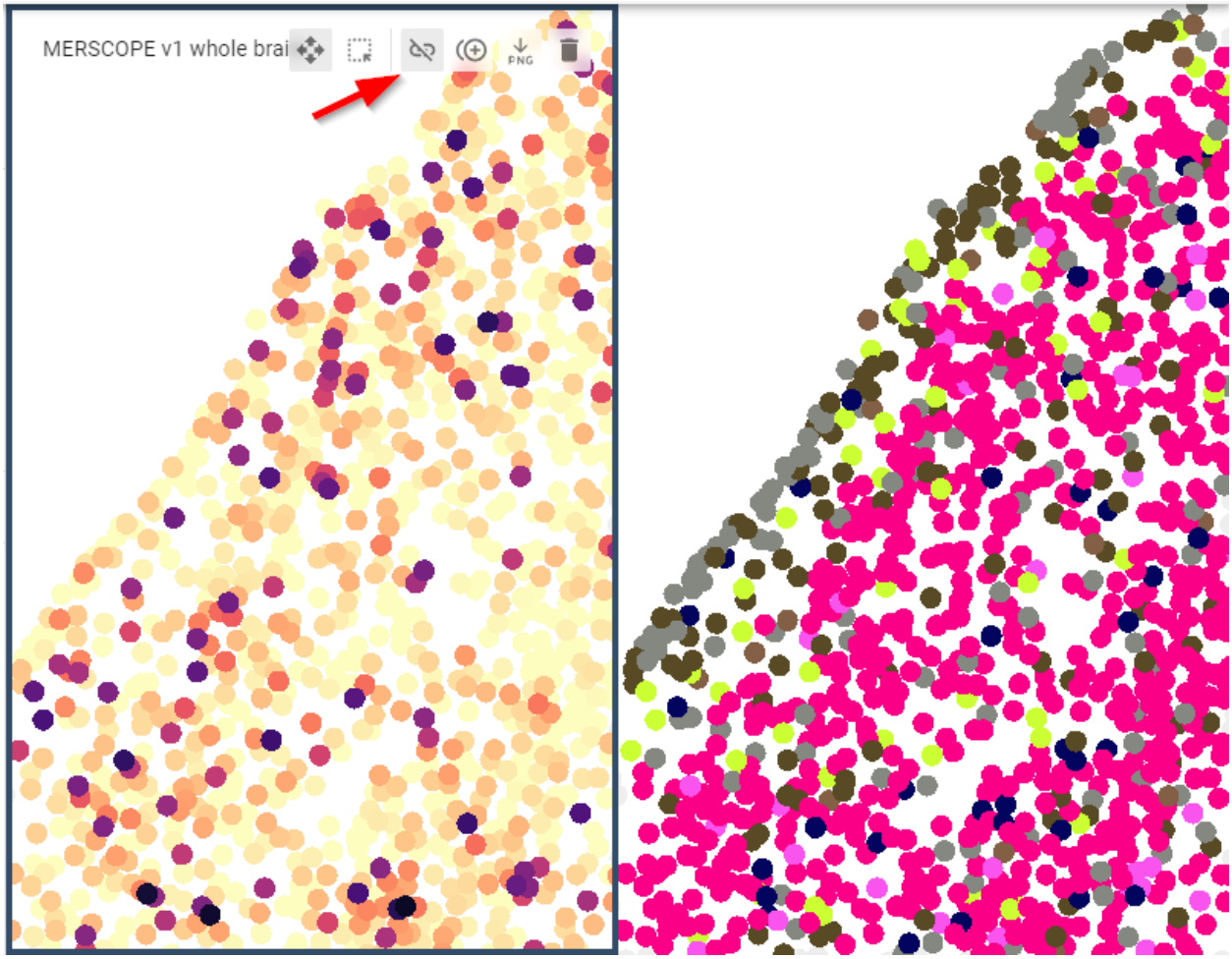

image801×622 52.5 KB

Tip: Enable syncing and duplicate a view to automatically sync the new view to the original

Slide View

Data sets comprised of spatial slices of tissue offer additional viewing options including the ability to scroll through slices while maintaining zoom and pan positioning.
Advance through slices in order using any one of the following mechanisms:

1. use the arrow buttons at the top of the view

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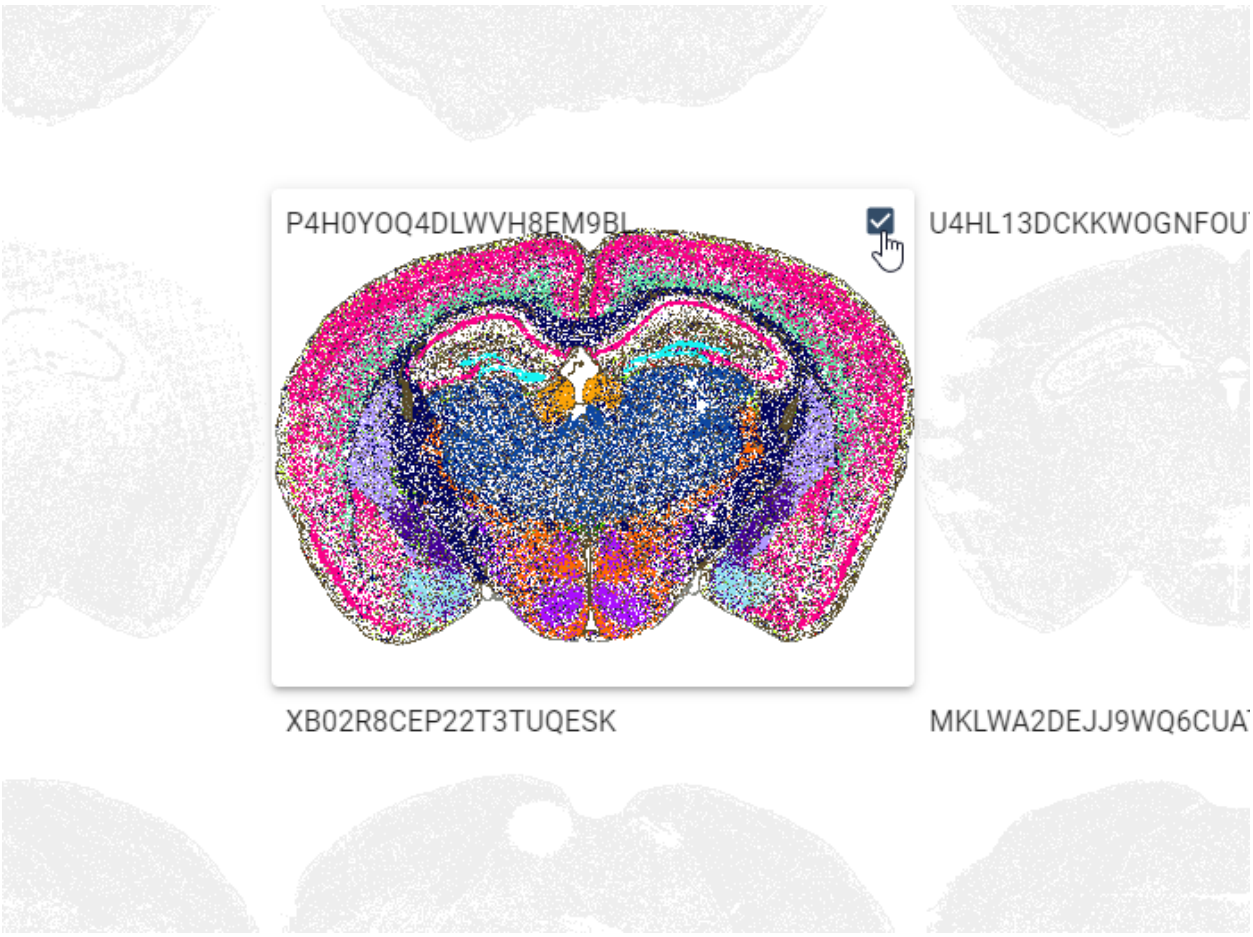
2. simultaneously hold the Alt key on Windows (Option key on Mac) and scroll the mouse wheel
3. hold the Alt key on Windows (Option key on Mac) and press the arrow keys

- Show or hide specific slices to create a custom view by checking the box in the upper right hand corner of each slide to be shown.



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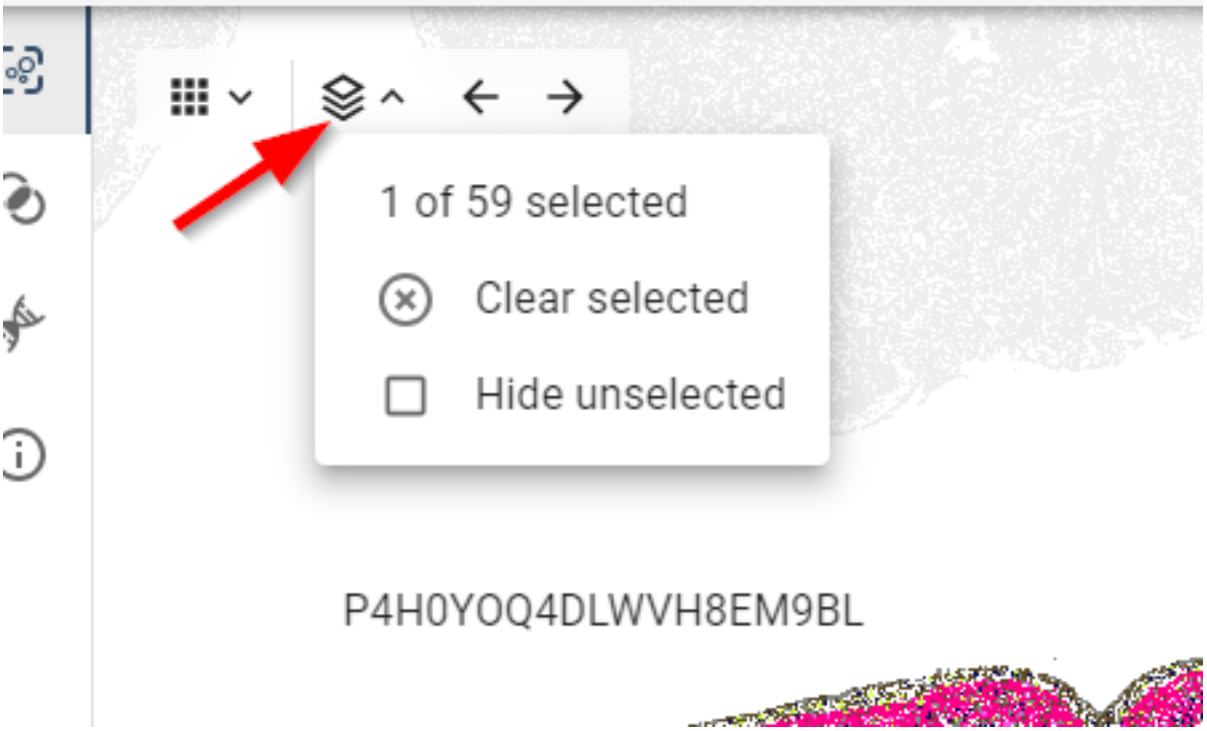
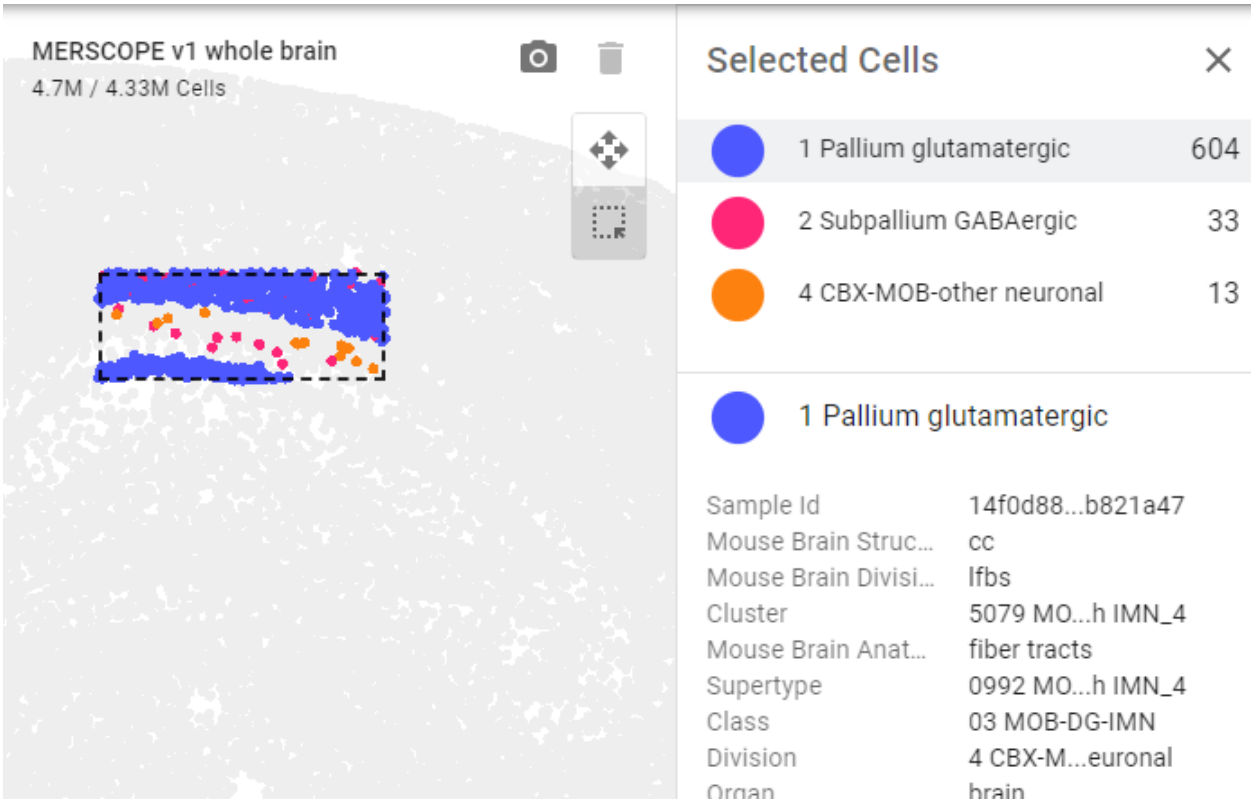
- To completely hide unselected slices, click “Hide unselected” from slide menu in the top left of the view.

- Pick “Clear selected” from the slide menu in the top left of the view to clear all selections or uncheck all boxes.



Cell Selection

- In Cell Selection mode, click and drag to highlight cells in a specific region of the visualization to open the Selected Cells panel.
- Once cells have been selected, the top portion of the Selected Cells panel displays an aggregated view of the cells in your cell selection region grouped by your current color selection.
- The bottom portion displays the details of each cell in the highlighted aggregation group. Click on a different aggregation group in the top section to switch groups.



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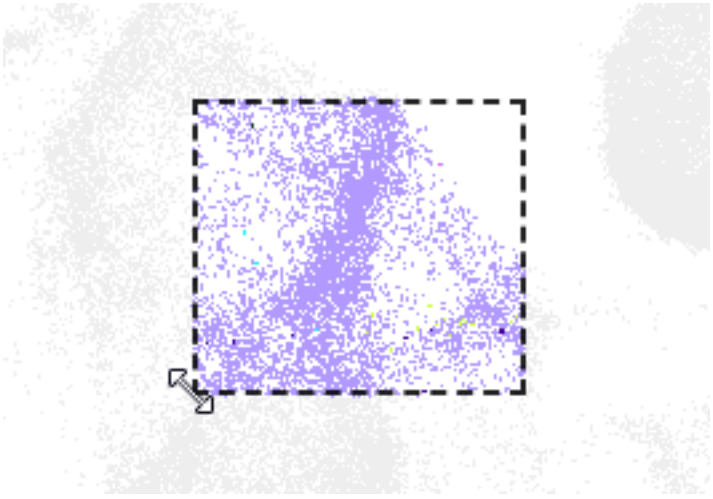
- Press the shift key once to enter Cell Selection mode. Press shift again to exit.
- Zoom & pan controls will continue to work even when in Cell Selection mode. Use the scroll wheel to zoom and hold the space bar to pan.
- When in Cell Selection mode, the selection box can be resized by hovering over the edge until the cursor becomes a double-sided arrow and then clicking and dragging to the desired size.



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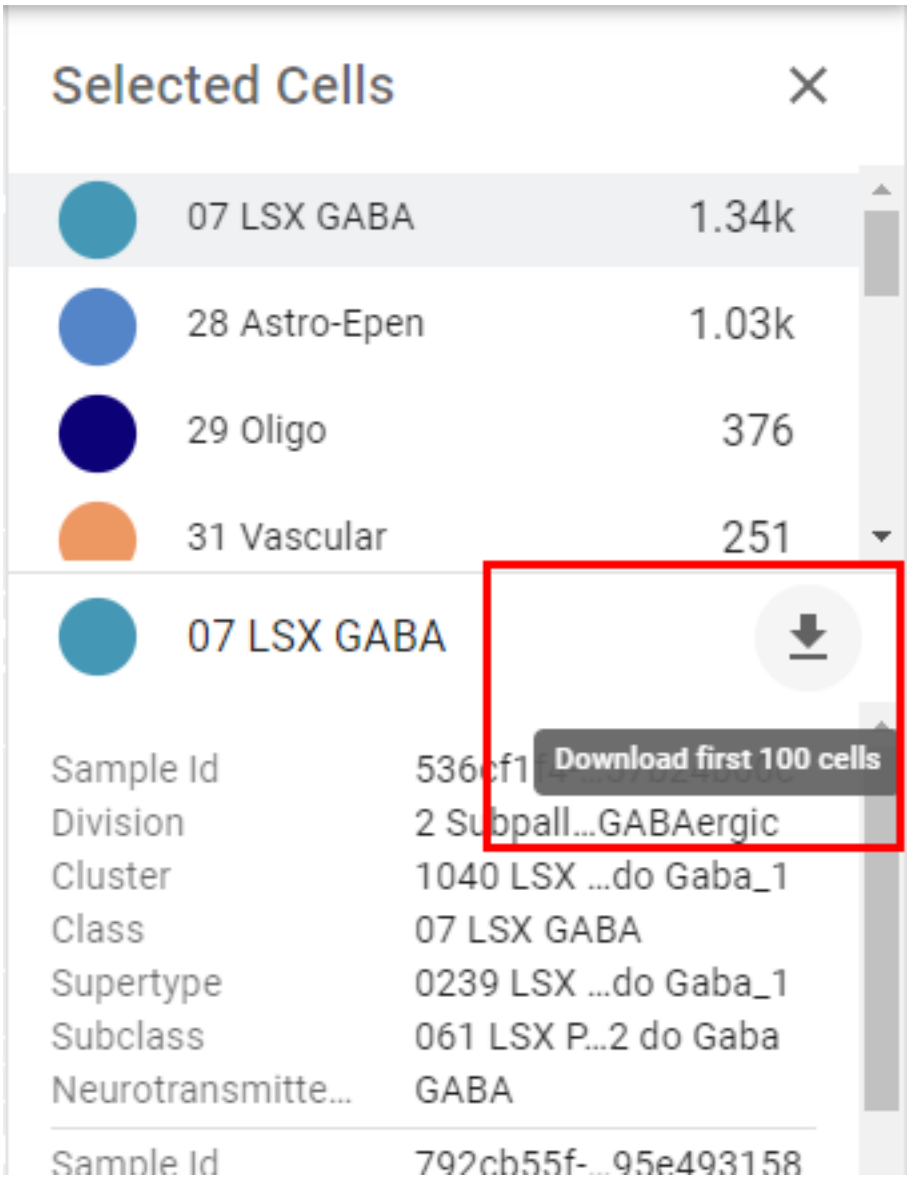
- While in the Cell Selection view, details of the selected cells can be downloaded as a csv file. Please note, only the first 100 cells will be included in the download. Full dataset download is available via GitHub .

1. Use the Zoom and Pan mode to focus in on the desired region of cells
2. Switch to Cell Selection mode and drag to select a specific set of cells
3. In the Selected Cells list, click on a aggregation group value
4. Click the arrow icon to initiate the download



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Other Resources

Video tutorial short version: https://www.youtube.com/watch?v=HBD-rAqBJCw
Full webinar: https://www.youtube.com/watch?v=mwyPZJrvJyQ
Catalog of Supportive Material:
https://portal.brain-map.org/help-and-community/guide-cell-types#How_to_use_ABC_Atlas

Acronyms

Astro: astrocyte
CB: cerebellum
CGE: caudal ganglionic eminence
CNU: cerebral nuclei
CR: Cajal–Retzius
CT: corticothalamic
CTX: cerebral cortex
CTXsp: cortical subplate
DG: dentate gyrus
EA: extended amygdala
Epen: ependymal
EPI: epithalamus
ET: extratelencephalic
GC: granule cell
HB: hindbrain
HPF: hippocampal formation
HY: hypothalamus
HYa: anterior hypothalamic
IMN: immature neurons
IT: intratelencephalic
L6b: layer 6b
LGE: lateral ganglionic eminence
LH: lateral habenula
LSX: lateral septal complex
MB: midbrain
MGE: medial ganglionic eminence
MH: medial habenula
MM: medial mammillary nucleus
MY: medulla
NN: non-neuronal
NP: near-projecting
OB: olfactory bulb
OEC: olfactory ensheathing cells
OLF: olfactory areas
Oligo: oligodendrocytes
OPC: oligodendrocyte precursor cells
PAL: pallidum
P: pons
STR: striatum
TH: thalamus

Chol: cholinergic
Dopa: dopaminergic
GABA: GABAergic
Glut: glutamatergic
Glyc: glycinergic
Hist: histaminergic
Nora: noradrenergic
Sero: serotonergic
NA: not applicable (no neurotransmitter detected)