NeuroNLP Gene Match—An open source genetic data visualizer and explorer

https://hemibraingene.neuronlp.fruitflybrain.org/ or https://gene.neuronlp.fruitflybrain.org/

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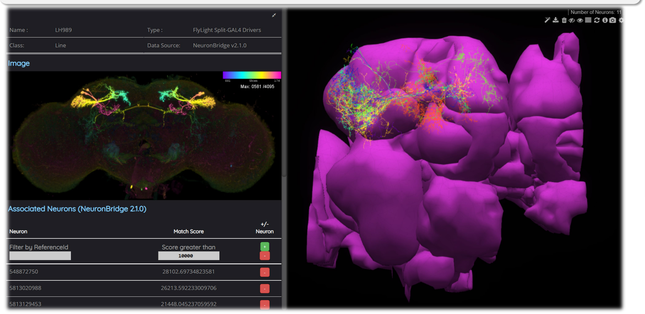
Overview

NeuroNLP Gene Match (NGM) is a web-based genetic expression and neural circuit explorer with advanced 3D visualization capabilities. NGM enables the:

- 3D exploration of Drosophila connectomics and gene expression (e.g., GAL4) datasets,
- Matching of neurons in connectomics datasets against registered light microscopy data and vice versa,
- Identifying neurons in a connectome or gene expression dataset given a 2D image in a publication.

Matching the FlyCircuit Connectome with the FlyLight GAL4 Dataset

NGM FlyCircuit matches ~3,500 GAL4 images against the FlyCircuit dataset. Matches for the driver line GMR10H02 are shown above.

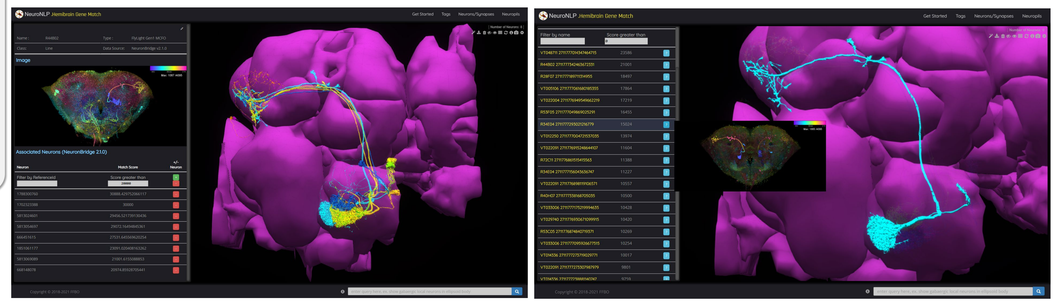


Hemibrain Connectome Matching w/ FlyLight MCFO and Split-GAL4 Datasets

NGM integrates the Hemibrain dataset and NeuronBridge, thereby enabling matches against data in the whole workspace, a single neuron, or an image.

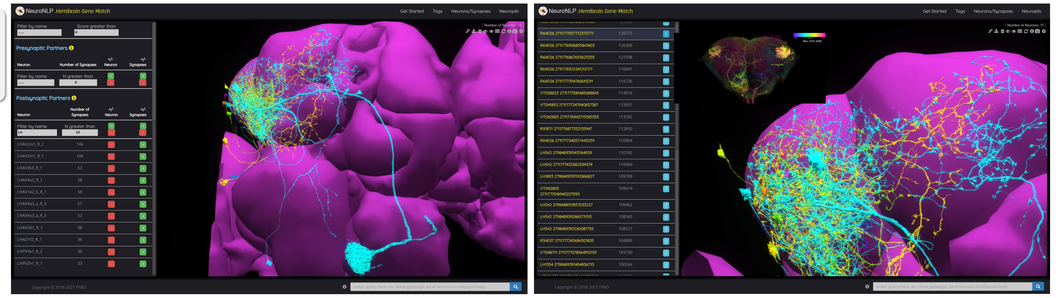
NeuroNLP Gene Match provides a 3D environment for jointly exploring the morphology, connectome, synaptome and gene expression datasets.

Exploring Neural Circuits with NeuroNLP Gene Match



By querying the name of a specific image, e.g., "load line #", info about the microscopy image and the connected neurons are provided on the left panel for visualizing more matches.

Hovering over and clicking on one of the neurons in the workspace, e.g., a VL2a adPN neuron on the left, can be further used to explore related images.



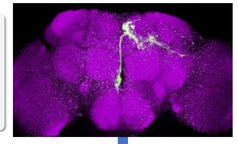
By clicking on one of the VL2a adPN neurons, we can also explore its postsynaptic partners and add LH neurons that exceed a specific synapse number threshold. 11 LH neurons with more than 30 synapses are displayed in the workspace.

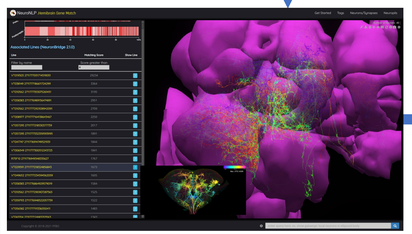
With the LH neurons in the workspace, best matches can be found for the aggregate set of neurons by clicking the "Get Matches for Workspace" button.

Matches can be made by starting from an image, a keyword, a single neuron or multiple neurons and these steps can be combined to discover, explore or specify neural circuits to be interrogated from within a single workspace.

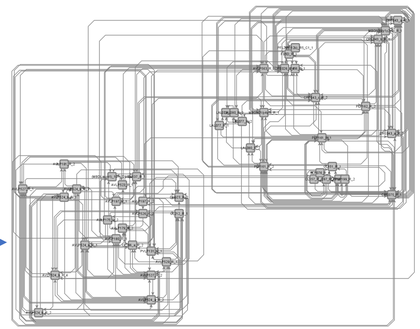
Mapping Figures in the Literature into Circuit Diagrams

Figure from the open literature.





Matching the figure to available datasets, exploring related data and saving the result as a tag.



Building on the tag to create a circuit diagram and explore its function with FlyBrainLab.

In the NGM/FlyBrainLab workflow shown above, the user starts with the image of the BPN neuron, finds possible matches for it in the Hemibrain dataset, and forms a circuit connecting the possible matches for future analysis of upstream and downstream circuits. The process ends up with a whole circuit that can be explored for computational modeling or generating experimental hypotheses with FlyBrainLab libraries.

References

[1] Lazar et at., doi: https://doi.org/10.7554/eLife.62362 ,
[2] FlyCircuit http://www.flycircuit.tw/
[3] Hemibrain https://www.janelia.org/project-team/flyem/hemibrain ,
[4] NeuronBridge, doi: https://doi.org/10.25378/janelia.12159378.v1
[5] Bidaye et al., doi: https://doi.org/10.1016/j.neuron.2020.07.032

Figures from the open literature can be matched against available datasets, neural circuits identified and subsequently loaded into the FlyBrainLab interactive computing platform for further analysis.

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