

Is a whole insect brain connectome bilaterally symmetric?

A case study on comparing two networks

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Aimed to define bilateral symmetry for a pair of networks, and formally test this hypothesis.	Found that left and right hemispheres are different under even the simplest model of a pair of networks	Left and right differ significantly in cell type connection probabilities, even when adjusting for the difference in density	Difference between hemispheres can be explained as combination of a network-wide and cell-type specific effects	Provided a definition of bilateral symmetry exhibited by this connectome, tools for future connectome comparisons
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Motivation

- Connectomes are rich sources of inspiration for architectures in artificial intelligence, but unclear which structural features are necessary for yielding incredible capabilities animal intelligences.
- Comparing connectomes

Larval *Drosophila* brain connectome

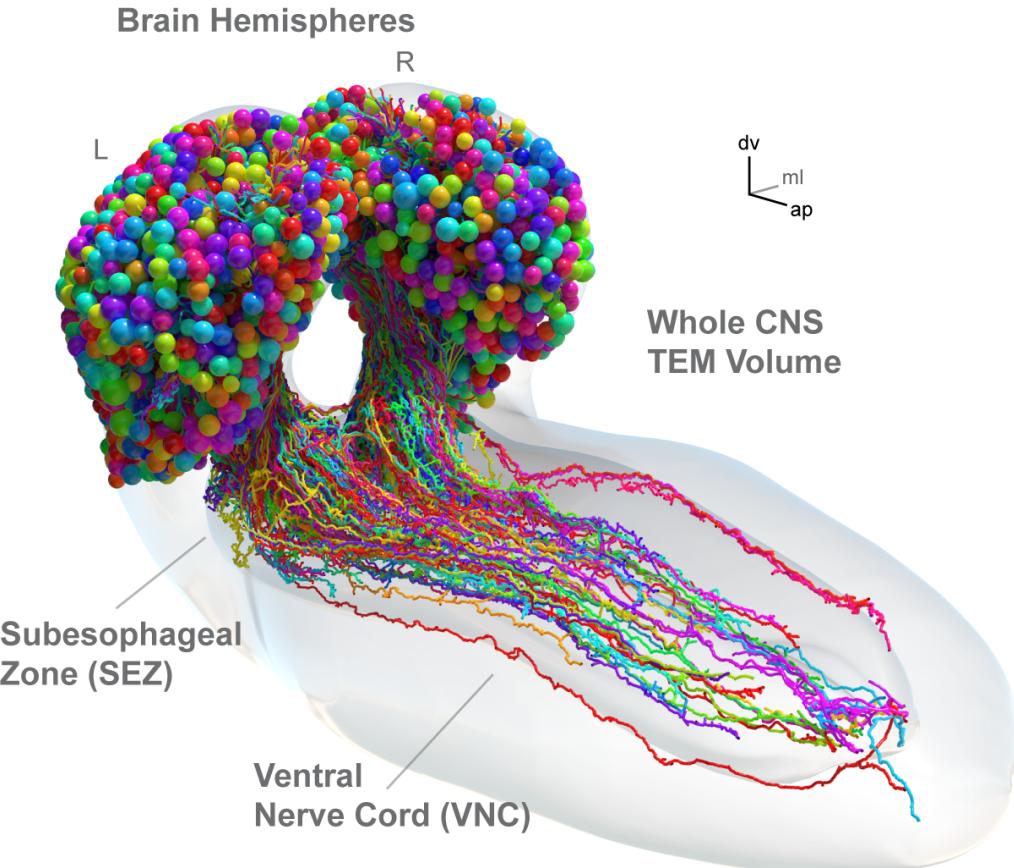


Figure 1: 3D rendering of larval *Drosophila* brain connectome

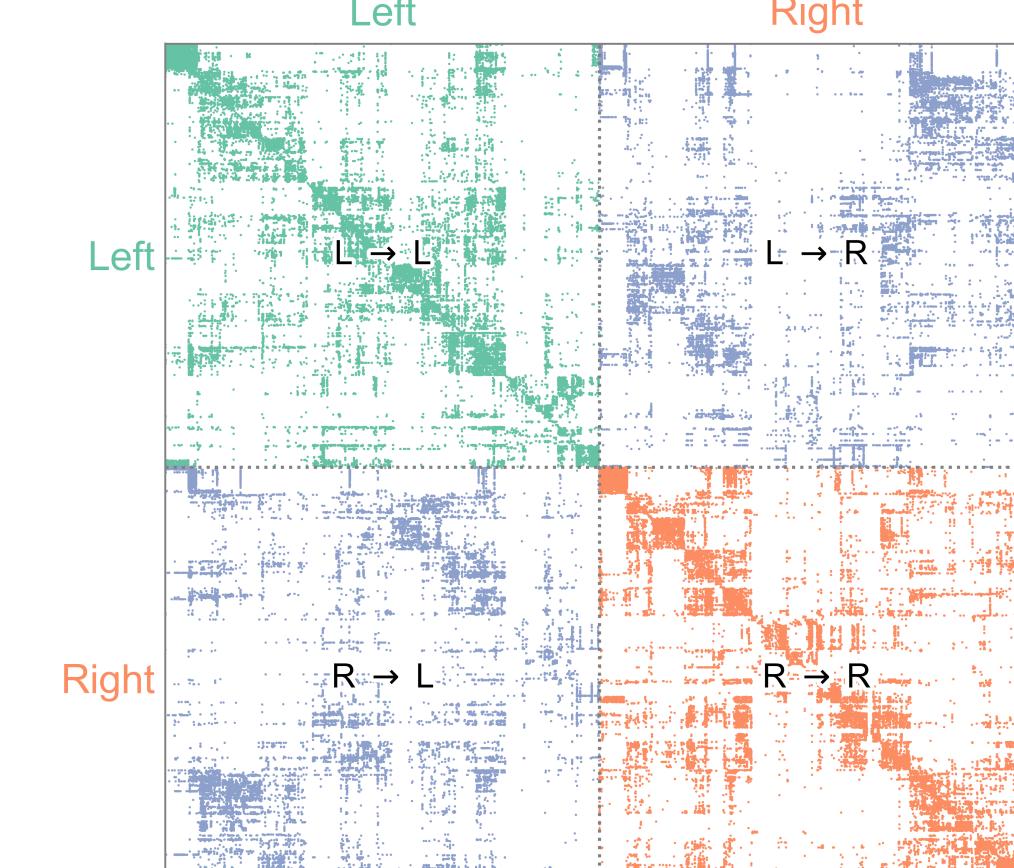


Figure 2: Adjacency matrix sorted by brain hemisphere

- Connectome of a larval *Drosophila* [1] has xxx neurons and xxx synapses
- Are left and the right networks "different"?
- Two sample testing problem! But for networks

Density testing

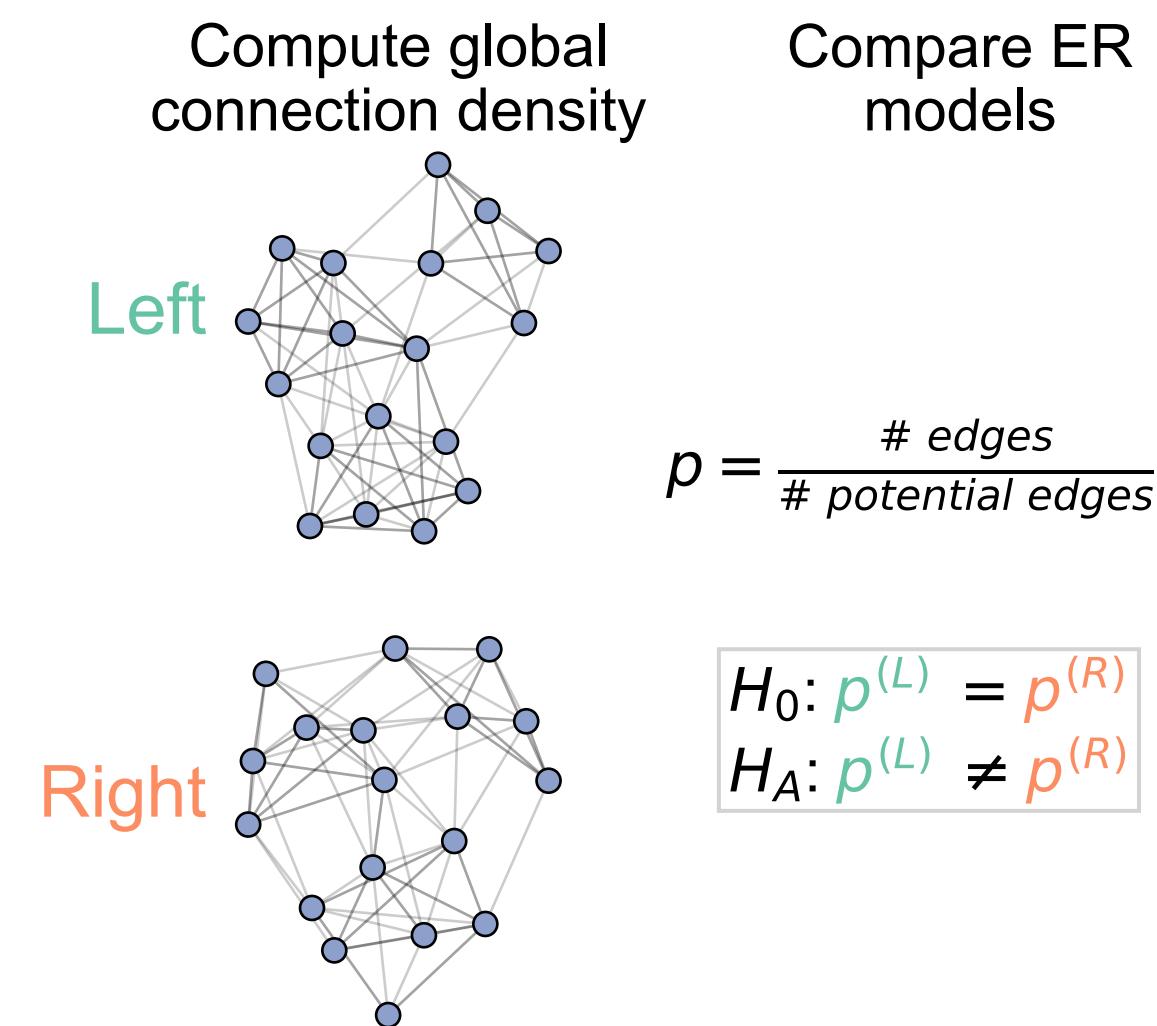


Fig 2A: Comparison of densities via Fisher's exact test

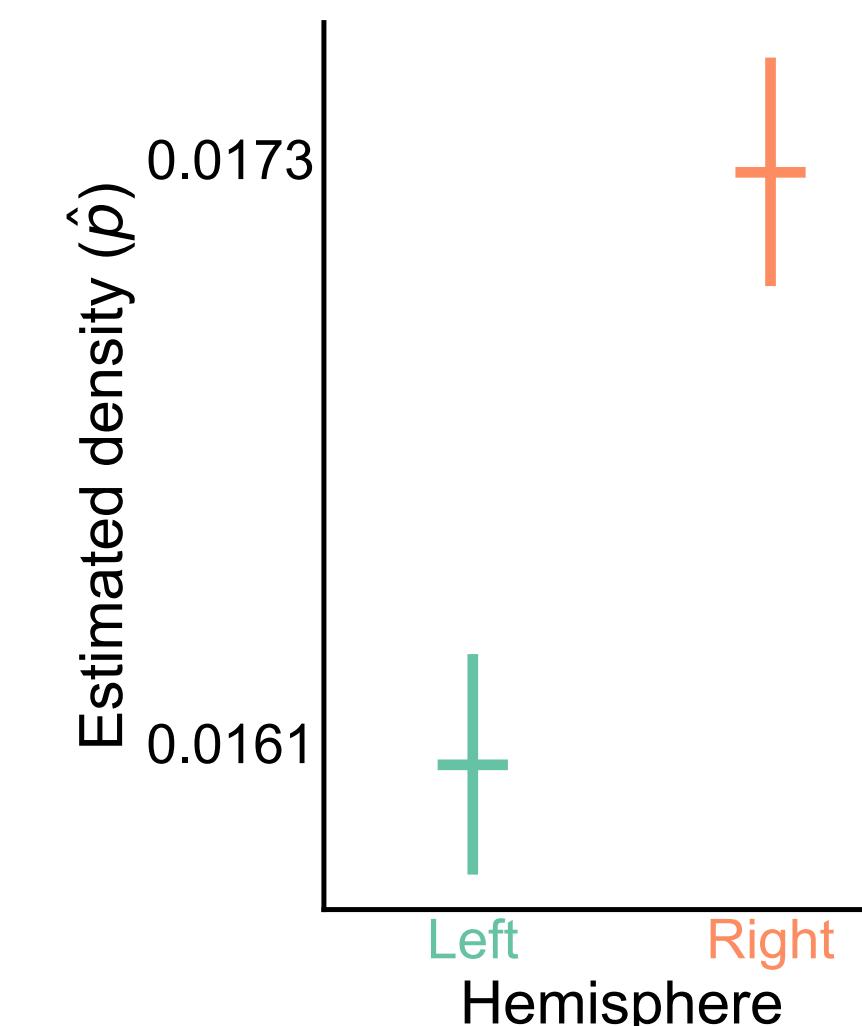


Fig 2B: Densities are significantly different between hemispheres ($p < 10^{-23}$)

Group connection testing

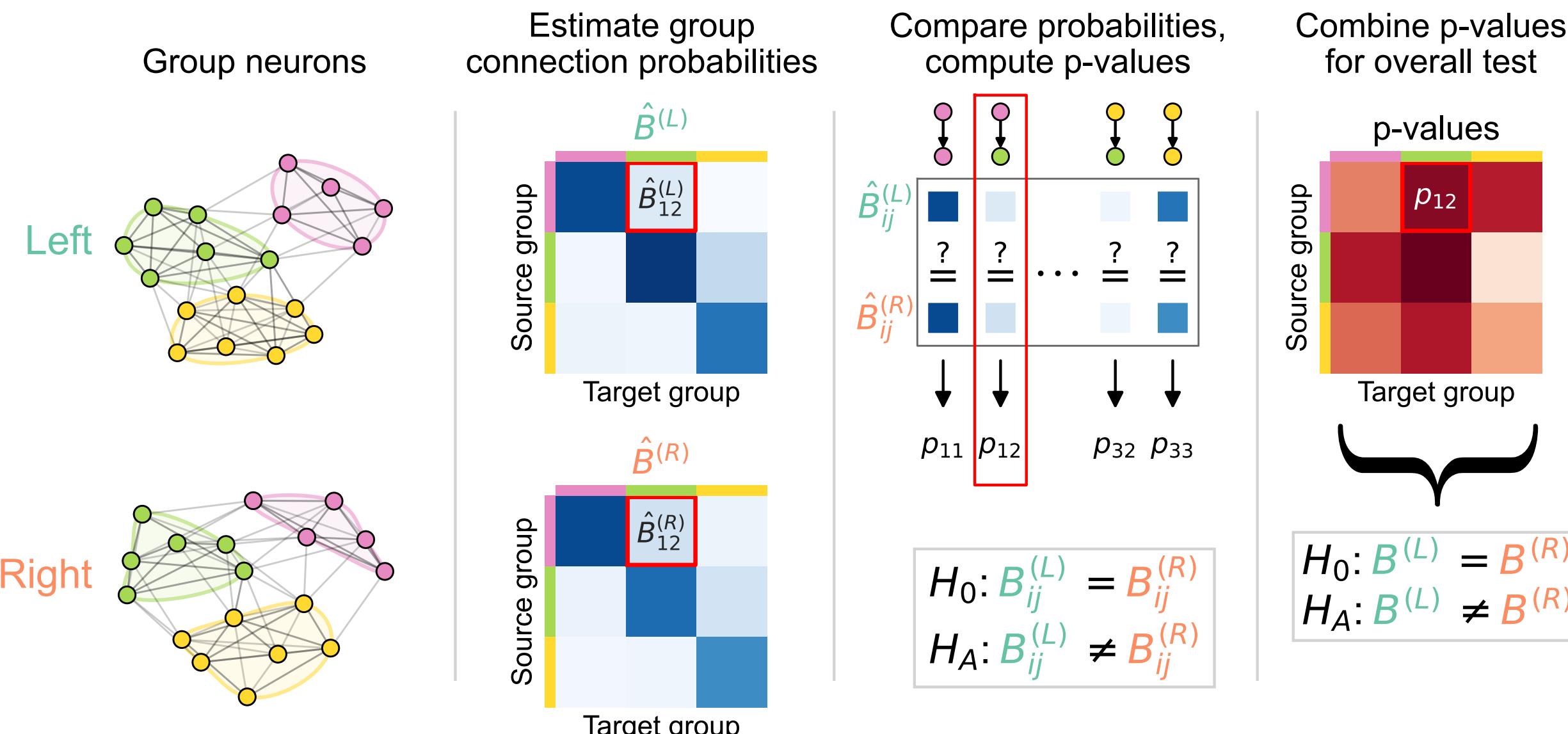
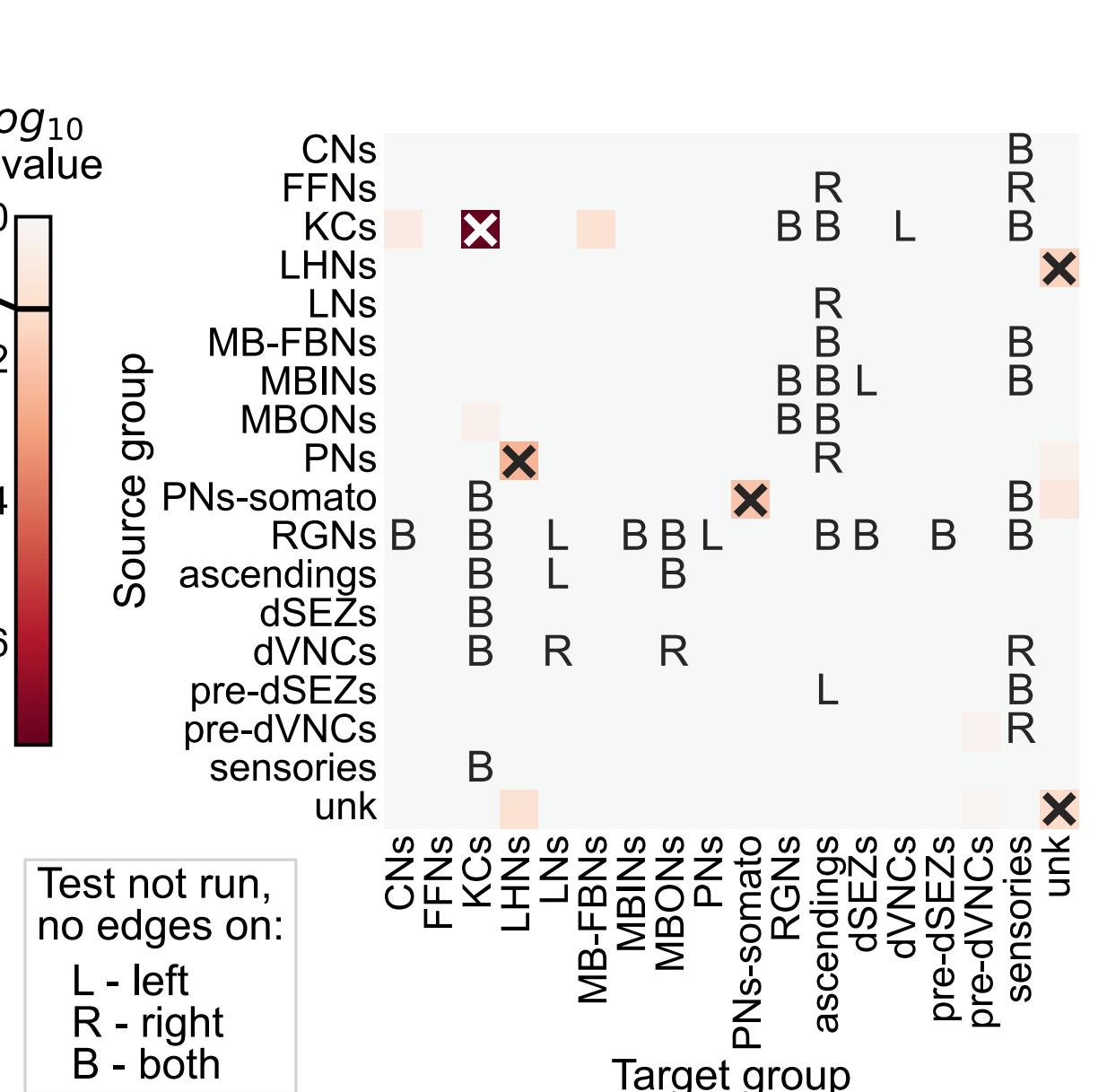


Fig 3A: Group connection testing fits SBMs using cell type partition. Group-to-group connection probabilities are compared (Fisher's exact test), p-values are combined (Tippett's method).



Density-adjusted group connection testing

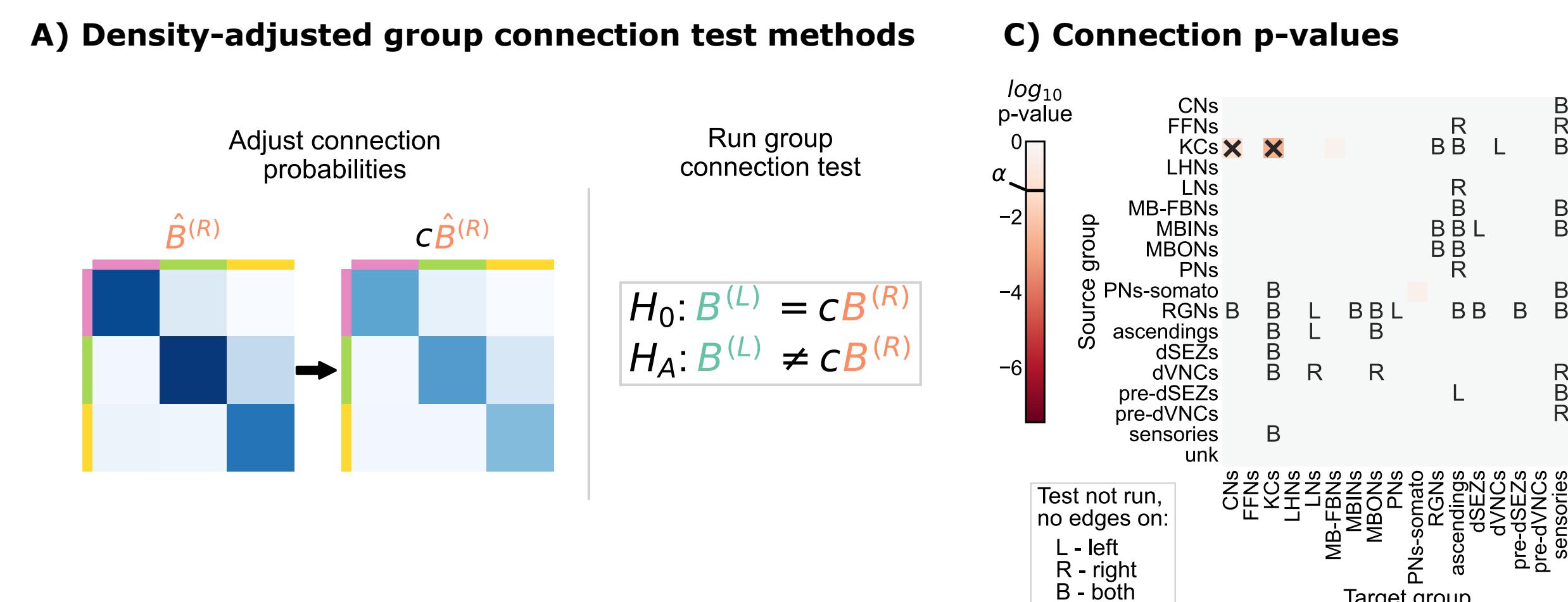
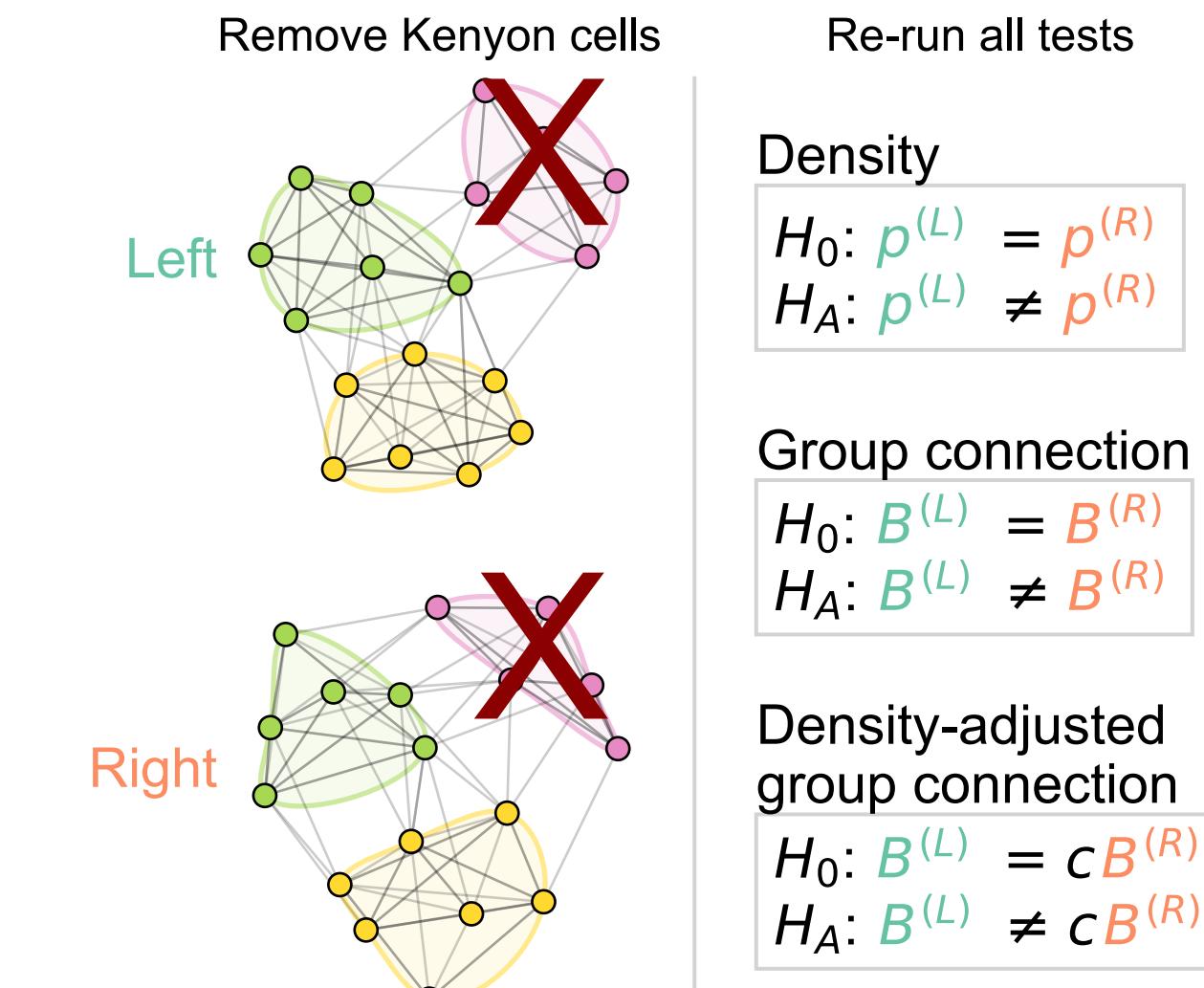


Figure x: Adjusted the hypothesis from figure

Removing Kenyon cells



Remove Kenyon cells

Re-run all tests

Density

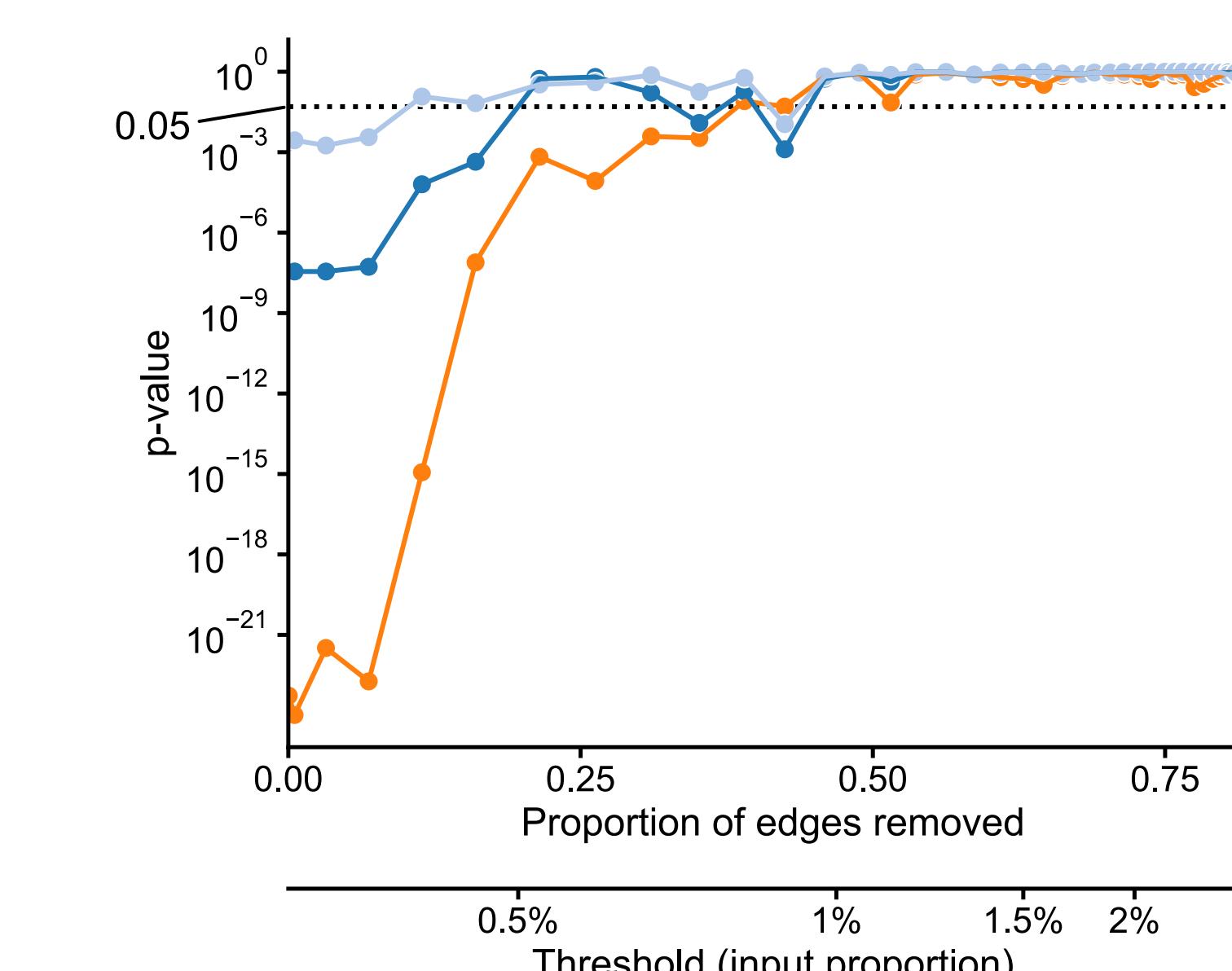
Group connection

Density-adjusted group connection

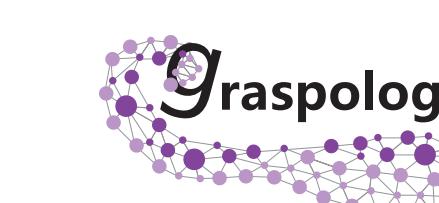
- Density test: super small
- Group connection test: small
- Density adjusted group connection test: not small

- some stuff about it
blah blah

Edge weight thresholds



Code



downloads 114k

Stars 244

JB jupyter book

github.com/neurodata/graspologic

github.com/microsoft/graspologic

References

[1]: Winding, Pedigo et al. *The complete connectome of an insect brain* In prep. (2022)