

Model-based comparison of connectomes: applications in a whole insect brain

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Acknowledgements



Mike
Powell



Eric
Bridgeford



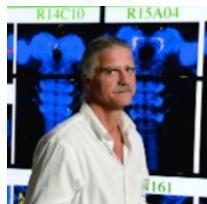
Michael
Winding



Marta
Zlatic



Albert
Cardona



Carey
Priebe



Joshua
Vogelstein

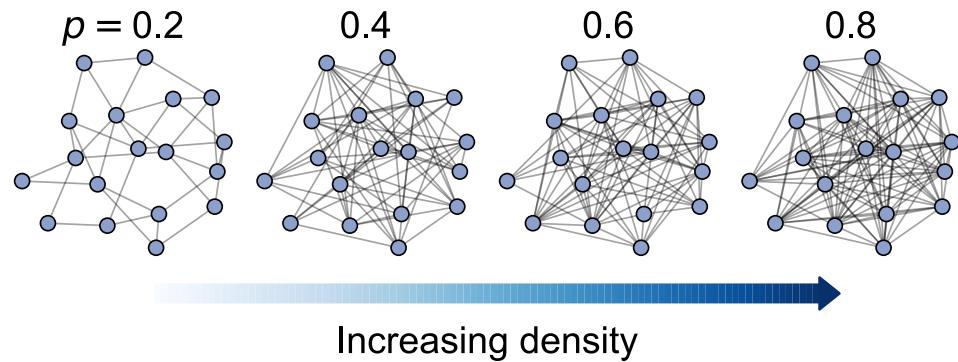
Larval *Drosophila* brain connectome



Are the **left** and **right** sides of this connectome
different?

We reject even the simplest notion of symmetry

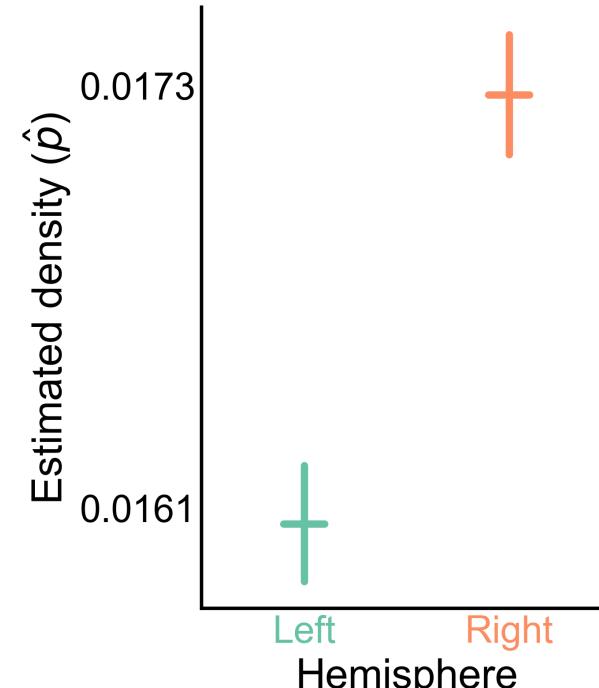
- Fit Erdos-Renyi models to the left and the right brain networks



- Compare densities:

$$H_0 : p^{(L)} = p^{(R)}$$

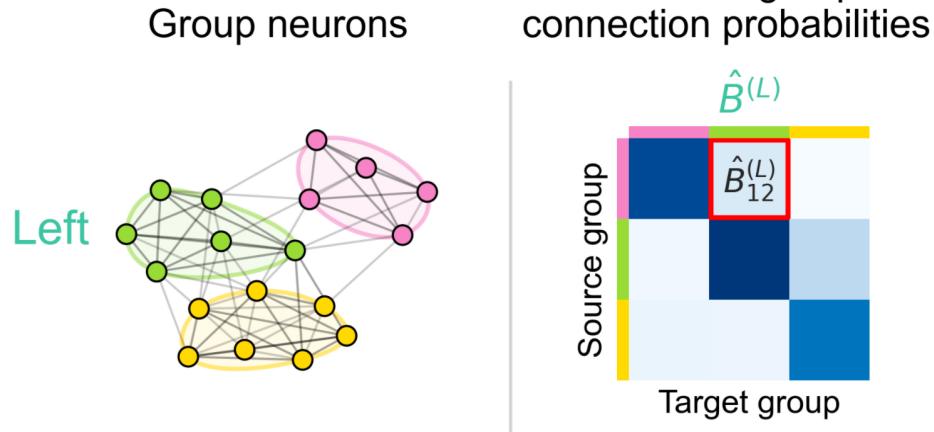
$$H_A : p^{(L)} \neq p^{(R)}$$



p-value: $< 10^{-23}$

Localizing differences to cell type connections

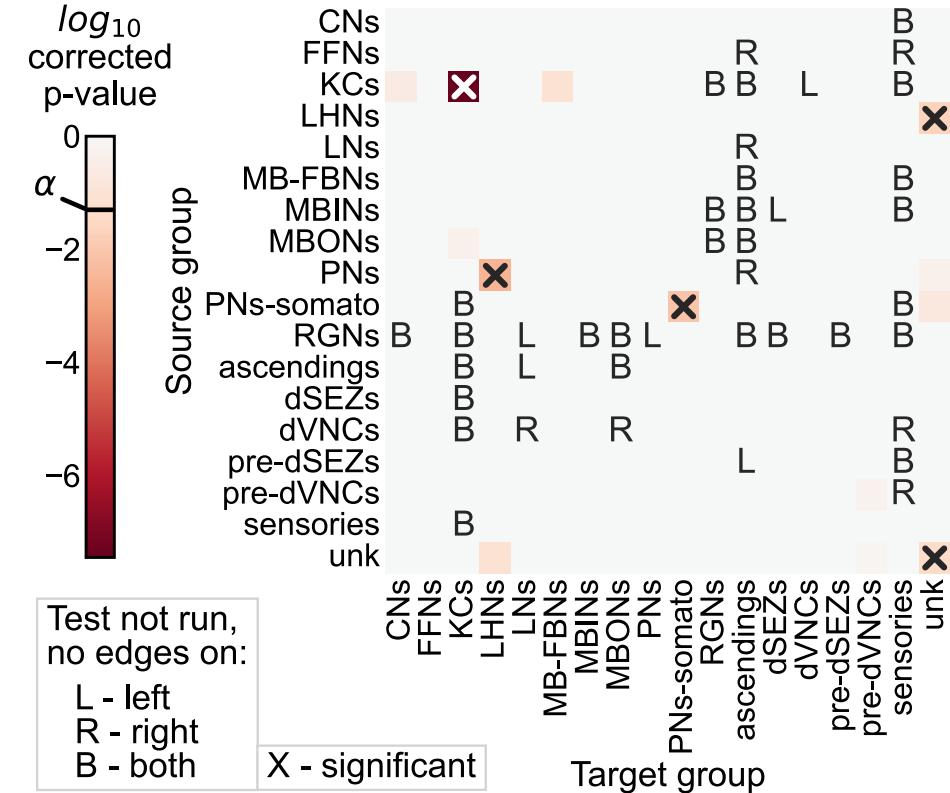
- Fit block models to both hemispheres



- Compare group connection probabilities:

$$H_0 : \hat{B}^{(L)} = \hat{B}^{(R)}$$

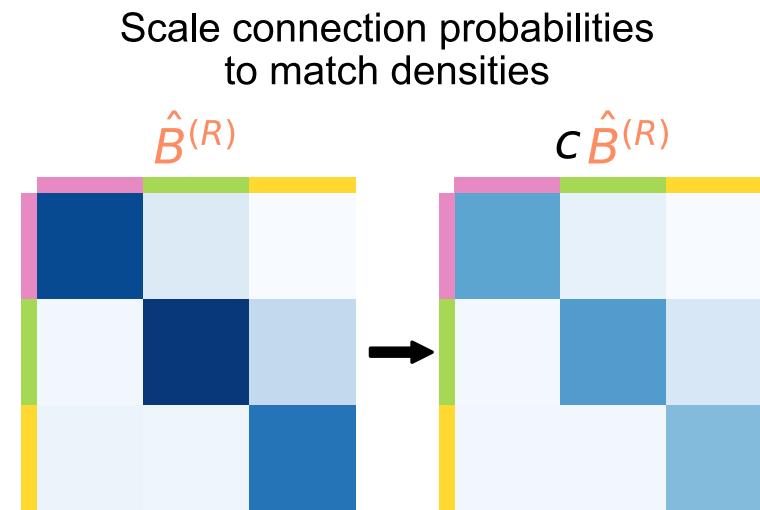
$$H_A : \hat{B}^{(L)} \neq \hat{B}^{(R)}$$



p-value: $< 10^{-7}$

Modified definitions of symmetry which ARE exhibited

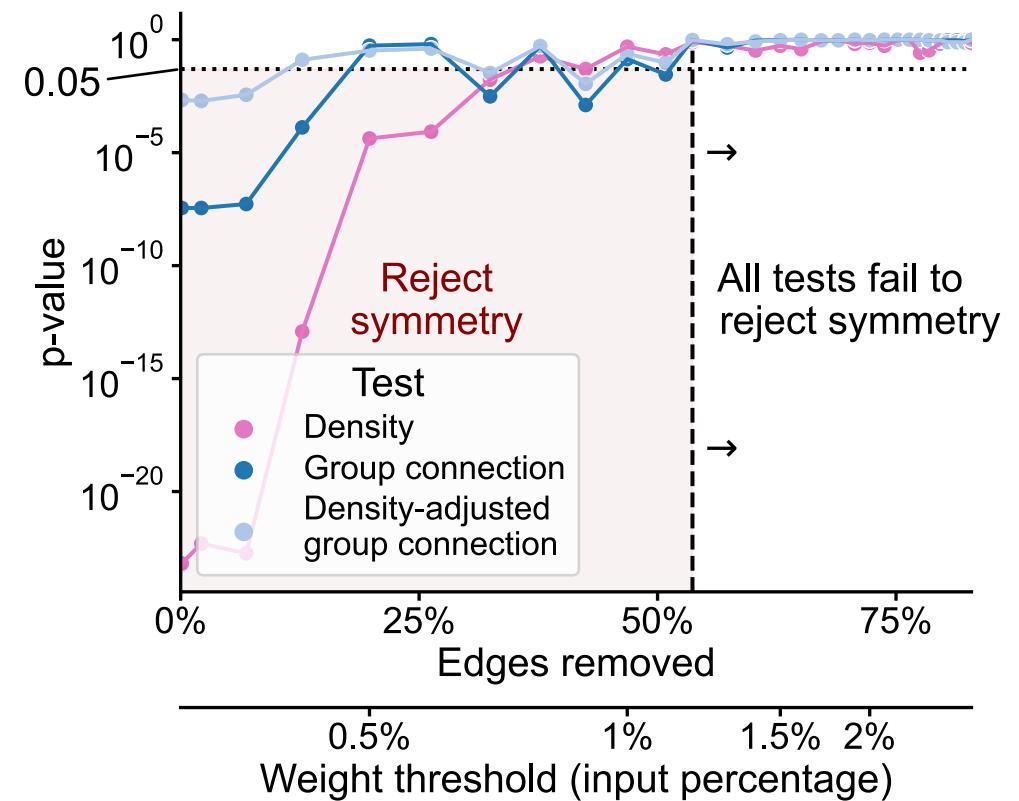
Rescaled connection probabilities AND removed Kenyon cells



$$\begin{aligned} H_0: & B^{(L)} = cB^{(R)} \\ H_A: & B^{(L)} \neq cB^{(R)} \end{aligned}$$

p-value: ~0.51

Used only high weight edges (by input proportion)



Conclusions

- Testing hypotheses in connectomics requires specialized techniques for networks
 - Presented 2-sample testing procedures for comparing connectomes
 -  downloads 121k
 - This work: github.com/neurodata/bilateral-connectome  jupyter book
- Applied these tools to evaluate bilateral symmetry, finding several ways in which this brain is/is not bilaterally symmetric
- Poised to apply to new datasets to answer...
 - **{Your question here}**
 - Get in touch:  bpedigo@jhu.edu  jovo@jhu.edu