

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

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## Acknowledgements



Mike  
Powell



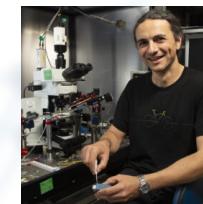
Eric  
Bridgeford



Michael  
Winding



Marta  
Zlatic



Albert  
Cardona



Carey  
Priebe



Joshua  
Vogelstein

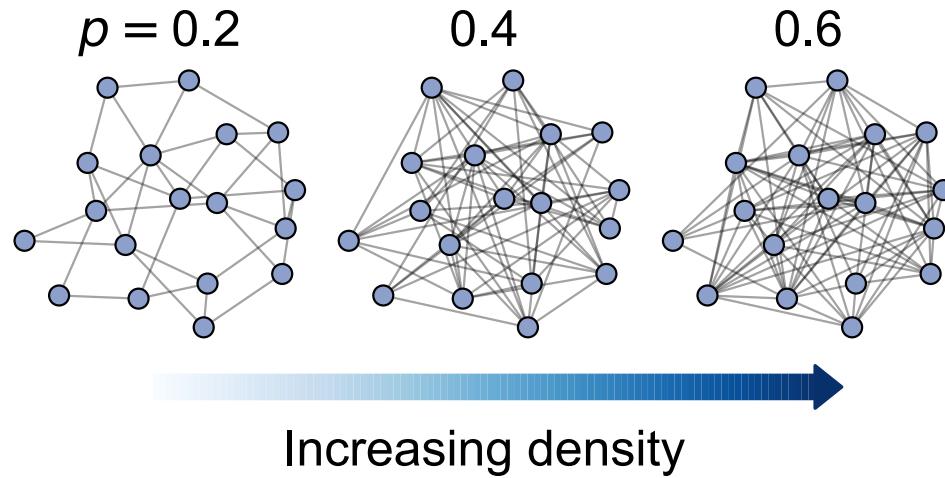
# Larval *Drosophila* brain connectome



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

# We reject even the simplest notion of symmetry

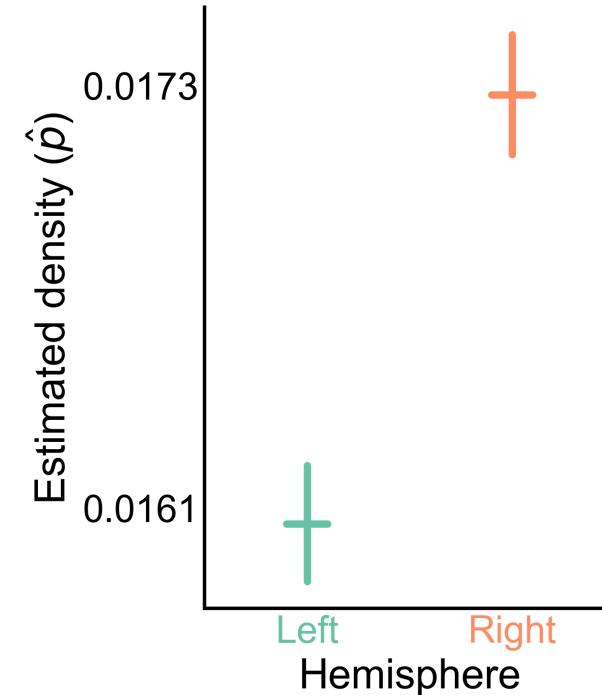
- Fit Erdos-Renyi models to the left and the right brain networks



- Compare densities:

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

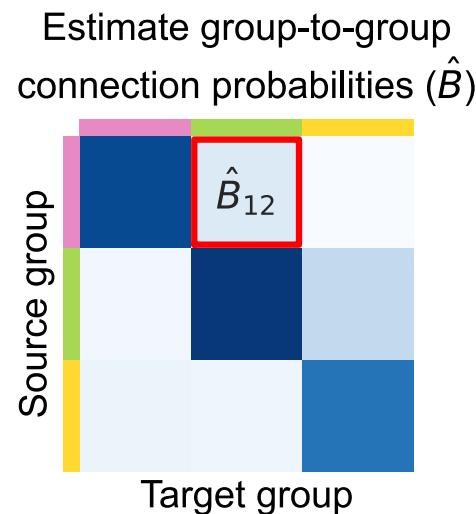
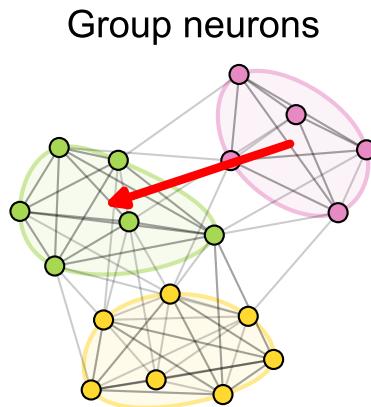
$$H_A : p^{(L)} \neq p^{(R)}$$



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

# Localizing differences to cell type connections

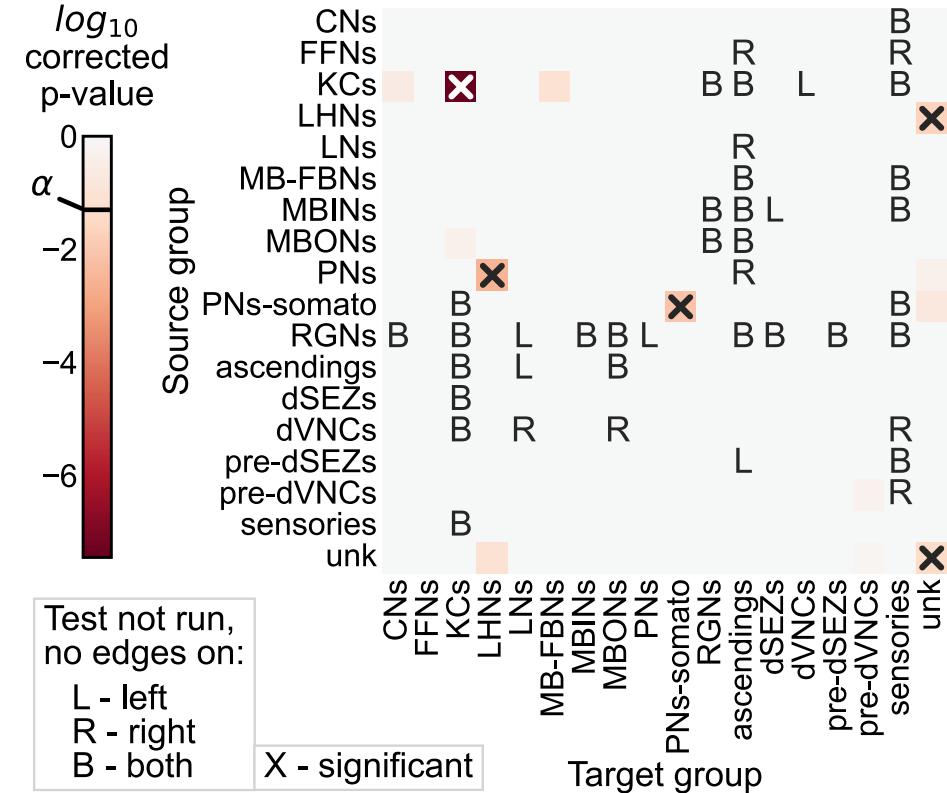
- Fit block models to both hemispheres



- Compare connection probabilities:

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

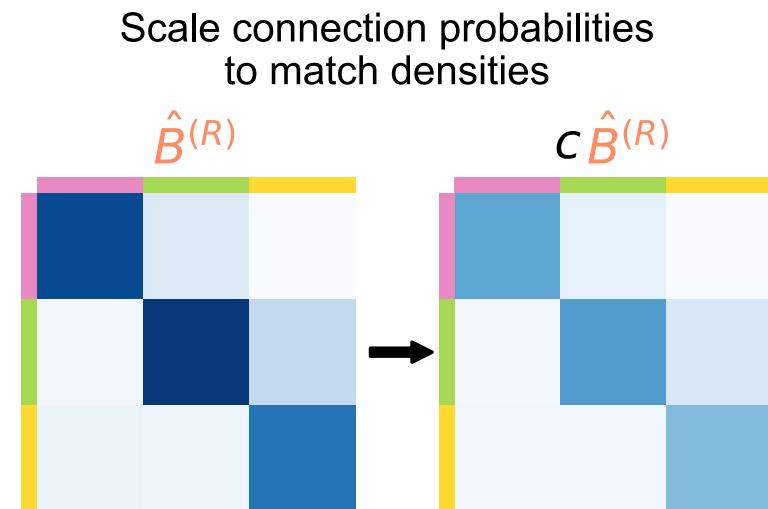
$$H_A : B^{(L)} \neq B^{(R)}$$



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

# Modified definitions of symmetry which ARE exhibited

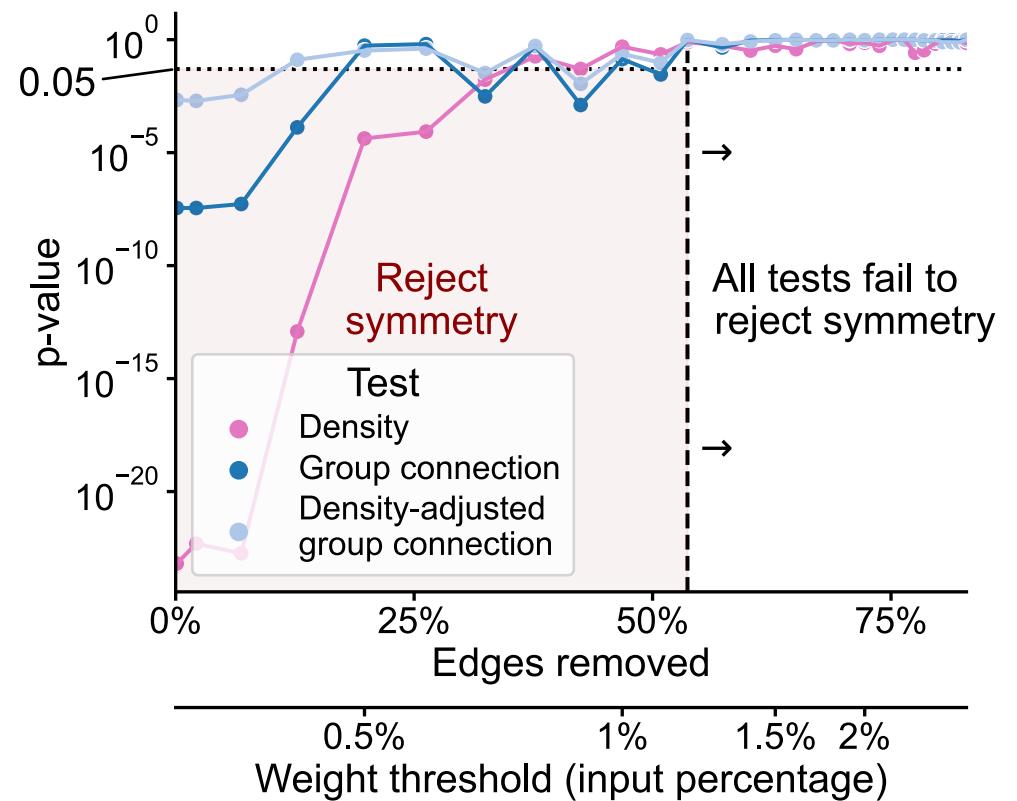
Rescale connection probabilities AND  
remove Kenyon cells



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

p-value: ~0.51

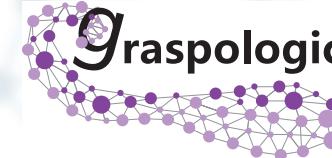
Threshold by edge weight (input  
proportion to postsynaptic neuron)



# Conclusions

- Testing hypotheses in connectomics requires techniques for networks
  - We presented procedures for comparing connectomes
- Used to evaluate bilateral symmetry, finding how this brain is/is not bilaterally symmetric
- Poised to apply these tools to answer...
  - {Your question here}
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# More info

-  [Graspologic](#) downloads 121k
- This work:  [jupyter](#) [book](#)  
[github.com/neurodata/bilateral-connectome](https://github.com/neurodata/bilateral-connectome)
- Chung et al. *Statistical connectomics* (2021)
- Data: Winding, Pedigo et al. *In preparation* (2022)