**Functional Connectivity between Premotor and Motor Cortex**
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**Background**
- Premotor cortex (PMC) and motor cortex (M1) are found to be major cortical areas associated with movement.
- Older experiments found evidence pointing to a functional hierarchy, with PMC driving M1 activity, but recent experiments have complicated this story.
- Recent advances now allow simultaneous recordings of hundreds of neurons during complex tasks, allowing interrogation of whether this functional hierarchy exists.

**Data Collection**
- Mice perform a head-fixed climbing task, while Neuropixel probes record hundreds of neurons in RFA and CFA, mouse homologues of PMC and M1 respectively.

**Measuring Functional Connectivity**
- Extended transfer entropy (TE) is used to see if activity in one region drives activity in another region after a time delay.

**Figure 1.** A) Locations of RFA (PMC) and CFA (M1) in mouse brain. B) Image of mouse performed climbing task

**Figure 2.** Schematic of using transfer entropy on spike trains between pairs of neurons

**Figure 3.** P-values from RFA->CFA and CFA->RFA are overlayed on top of each other. The large number of overlapping purple on the leftmost bin (p<0.05) indicates a high number of statistically significant bidirectional functional connectivities.

**Figure 4.** A) Visualization of bidirectional connections between RFA and CFA as bipartite graph. B) Zoomed in version on 5 neurons.

**Figure 5.** Degree distributions of RFA->CFA and CFA->RFA

**Figure 6.** A) Projection of bipartite network onto RFA. B) Projection onto CFA

**Conclusions**
1) RFA and CFA have bidirectional functional connectivity... and they are extremely interconnected!
2) Their degree distributions are mostly similar, although CFA->RFA seems to have a slight skew for higher degree nodes.
3) Further investigation using network theory on graphlets can be done to gauge direct vs indirect connections.