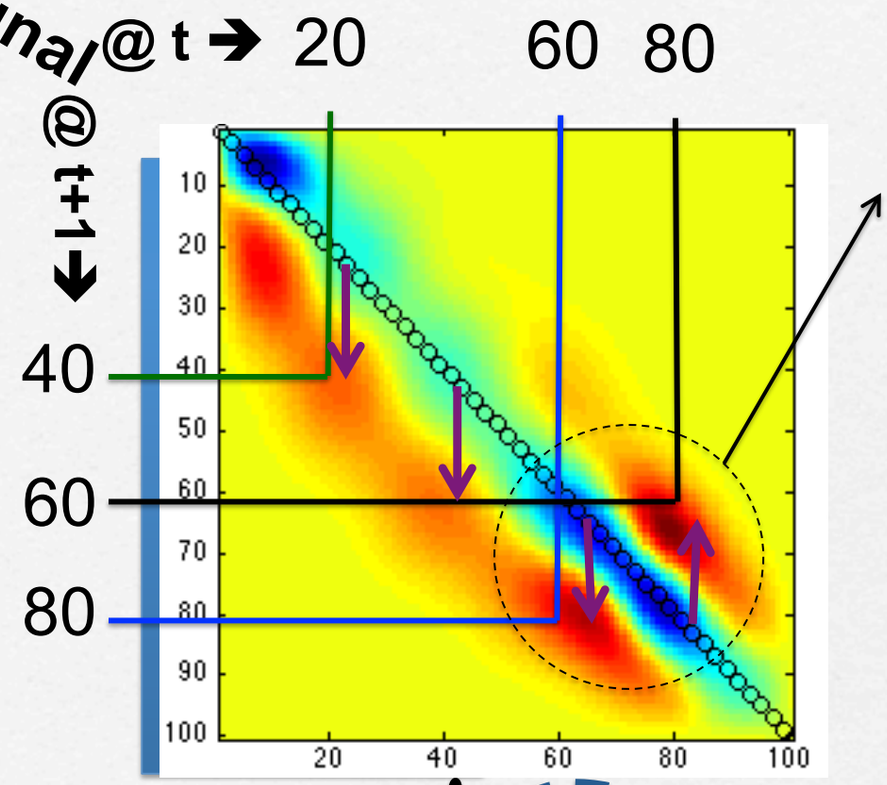
Stochastic dynamic operator (SDO) for neural analysis

State dependence

+

Spike triggered averaging

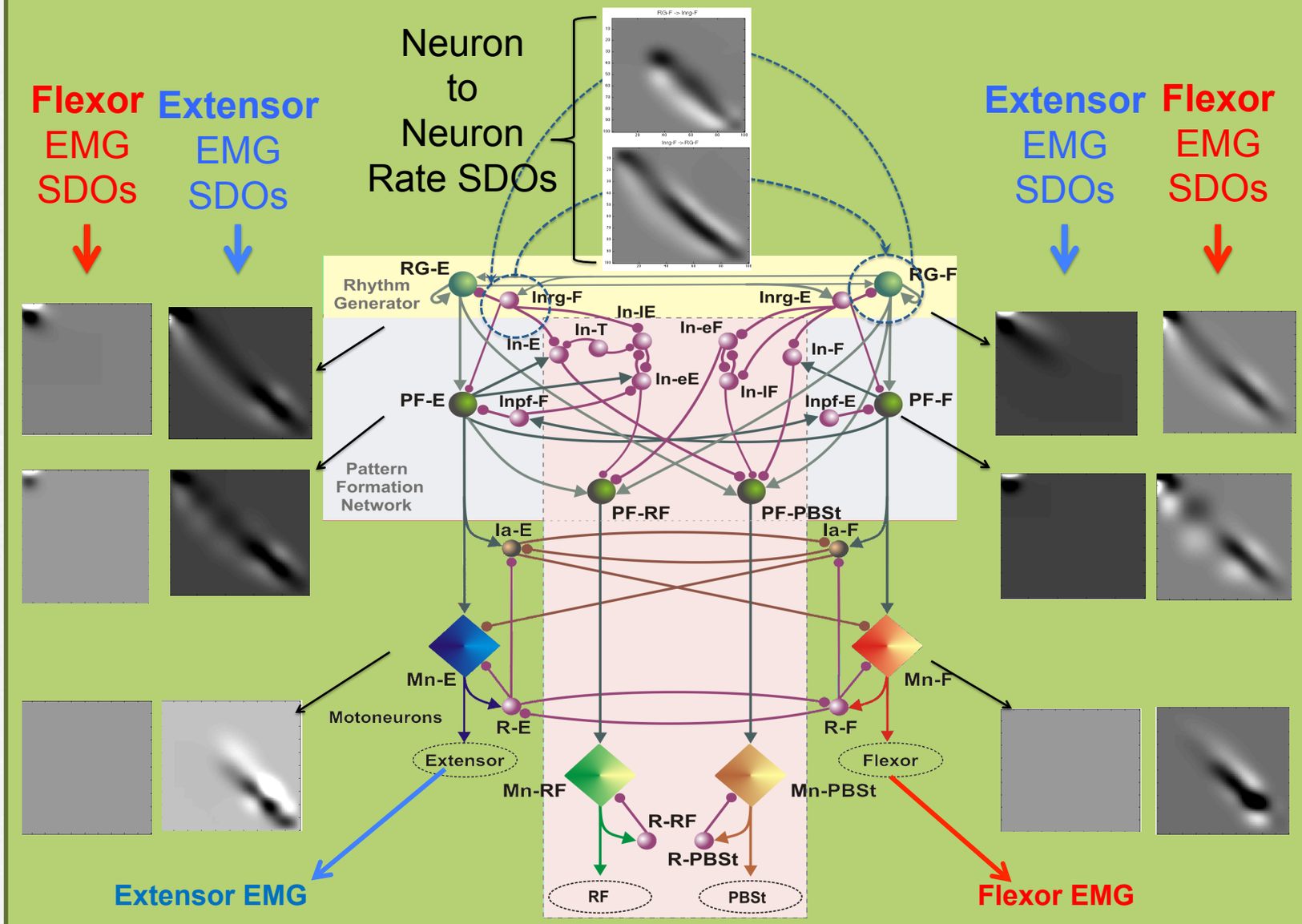
SDO



e.g.
EMG, Position, Velocity, Another neuron's activity

Terry Sanger
Simon Giszter

SDO discovers the pattern of connectivity in a simulated network

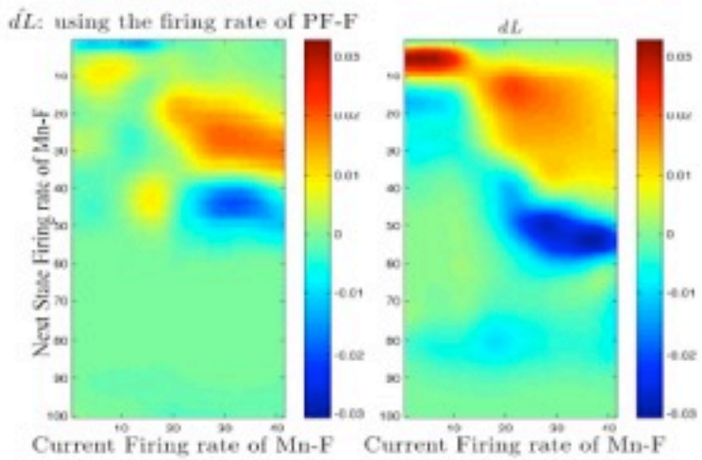


Circuit diagram by Rybak's group: N. A. Shevtsova et al. (2016), Modeling the organization of the spinal cord, In *Neuromechanical Modeling of Posture and Locomotion* (pp. 121–162), Springer Series in Computational Neuroscienece.

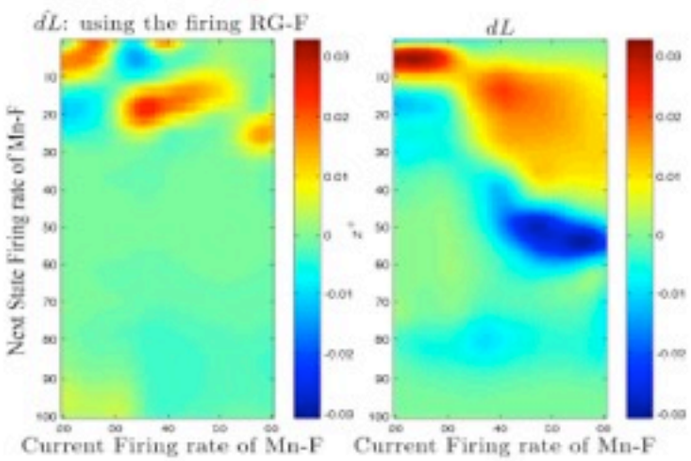
Discovering connectivity

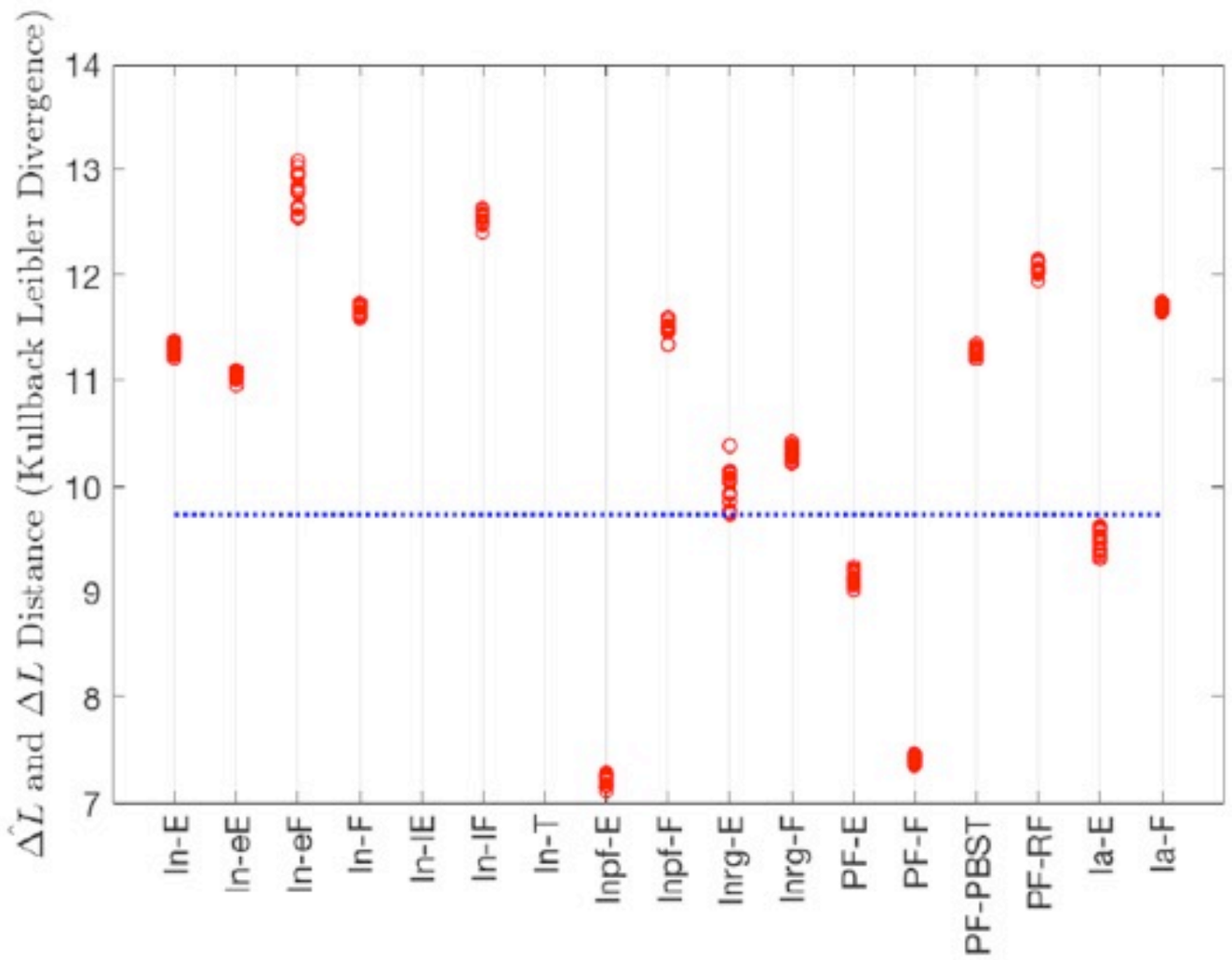
Example: Which neurons are in the pathway from PF-E to Mn-F?

PF-F ?✓



RG-F? ✗





Model Credibility Plan

- ☐ Validate SDO against known connectivity
- ☐ Predict neural firing from behavior
- ☐ Predict behavior from neural firing
- ☐ Predict individual neural firing from population firing
- ☐ Predict population firing from connected population firing

Validation

- Test-set validation of all predictions
- Sensitivity Analysis: compare predictions on randomly-selected subsets and shuffled data
- Predictive validity: compare with recorded EMG and firing datasets