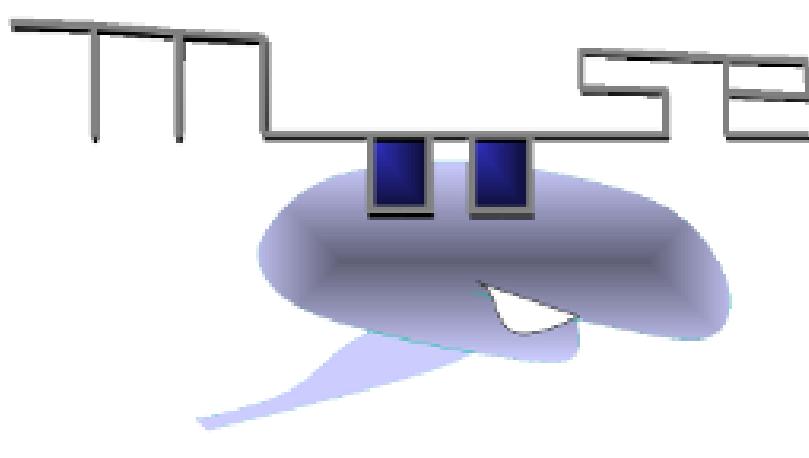


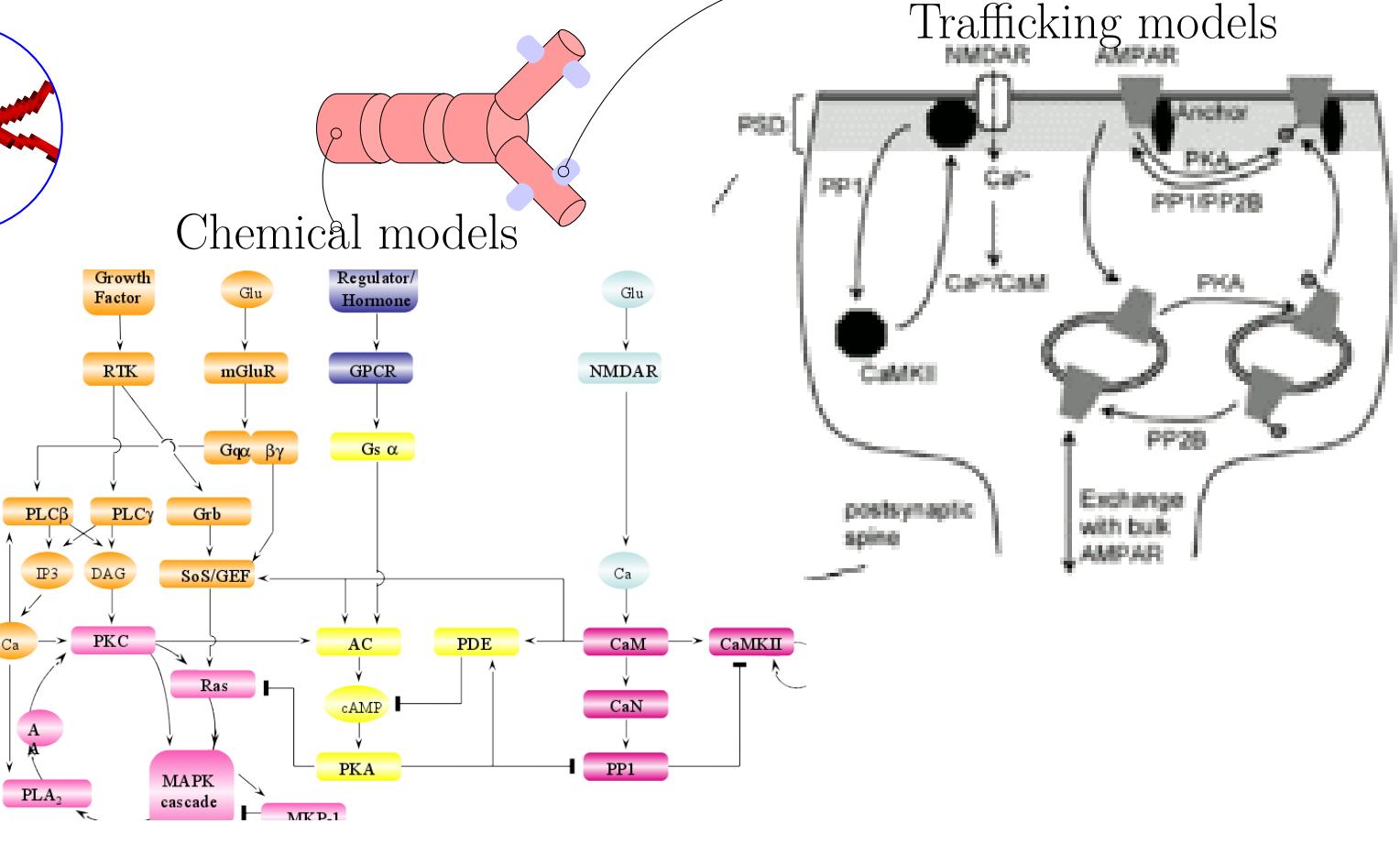
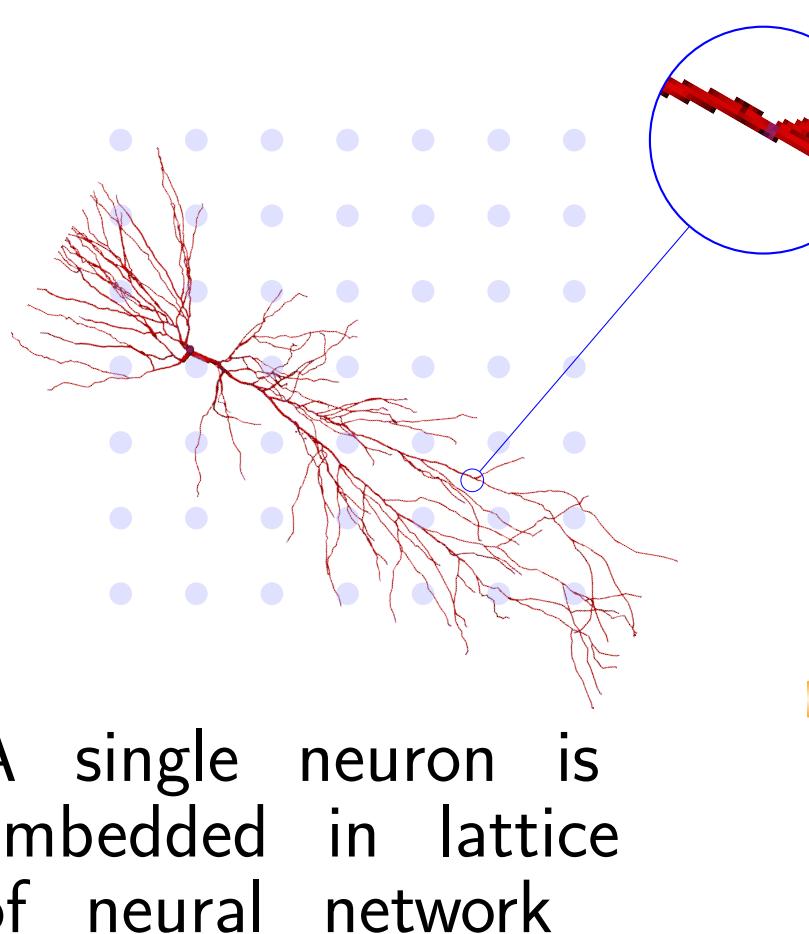
Modelling Memory Across Scales

Subhasis Ray, Harsha Rani, Sahil Moza, Aditya Gilra, Aviral Goel, Dilawar Singh, Upinder Bhalla



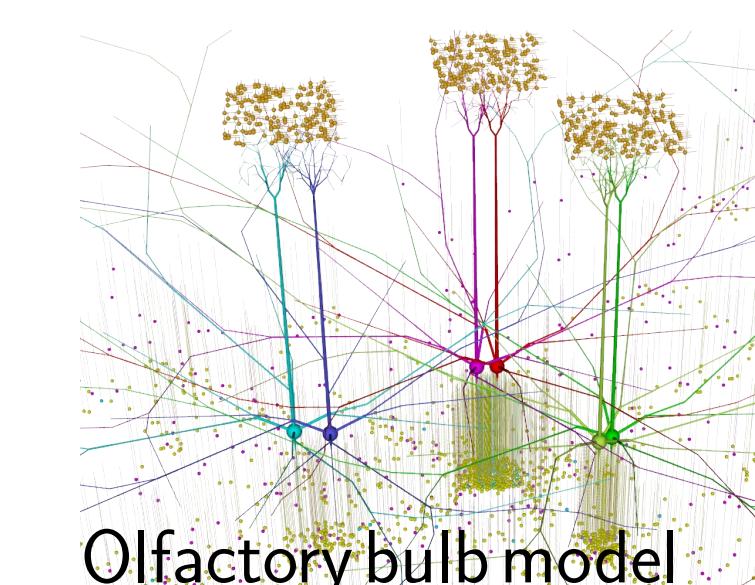
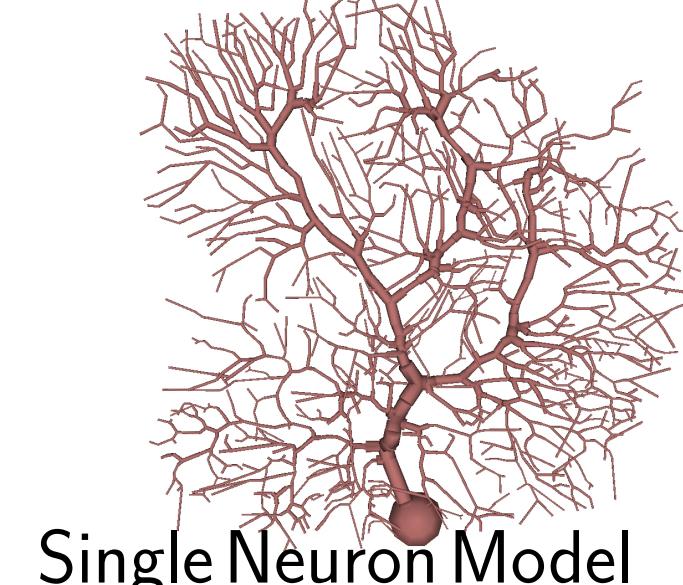
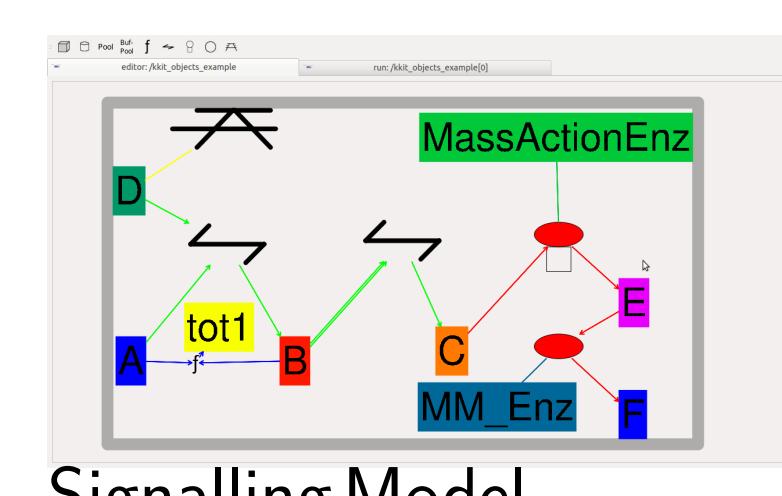
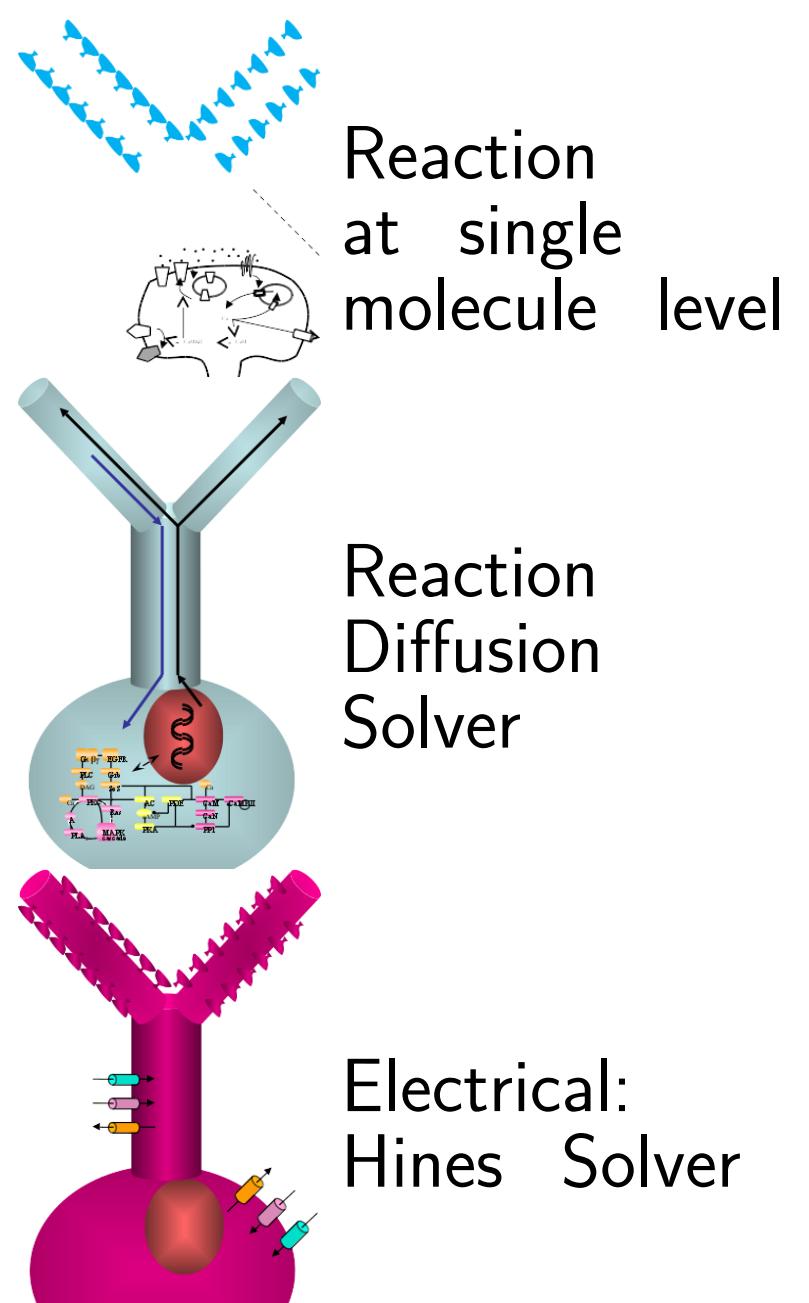
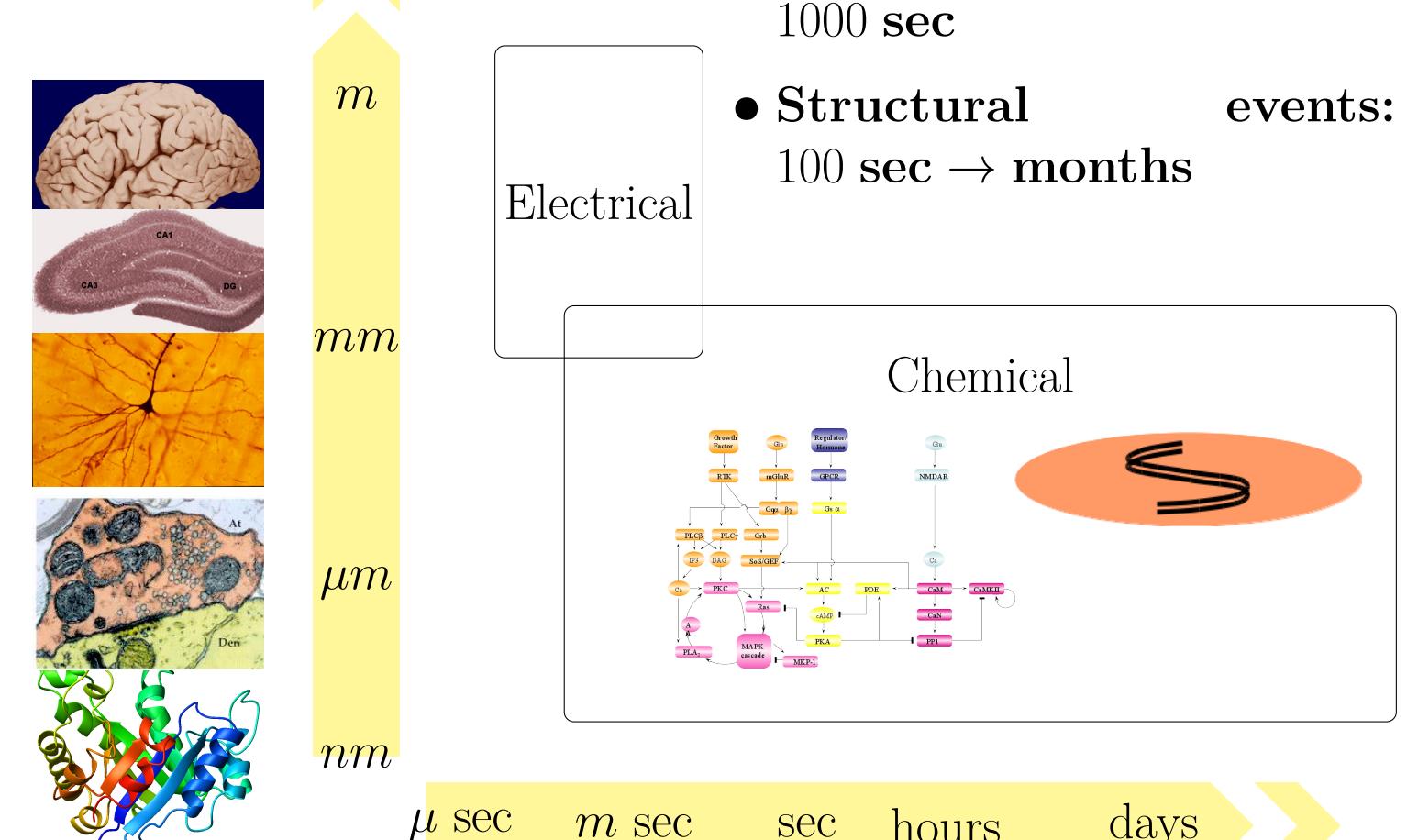
Why Multiscale?

- Memory and plasticity involve brain mechanisms from molecular scale to enormous networks.
- We have developed MOOSE the Multiscale Object Oriented Simulation Environment, to model plasticity across scales.

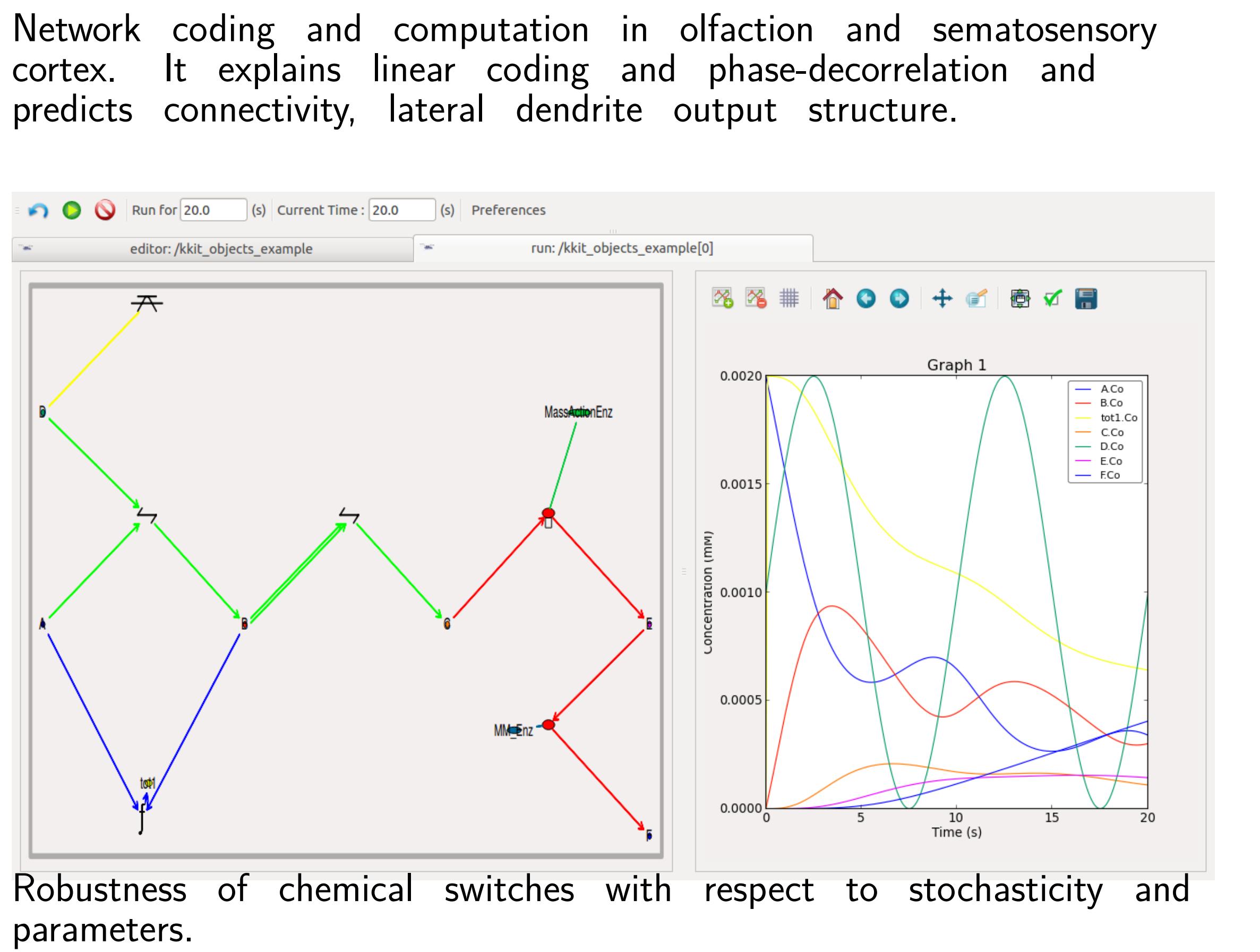
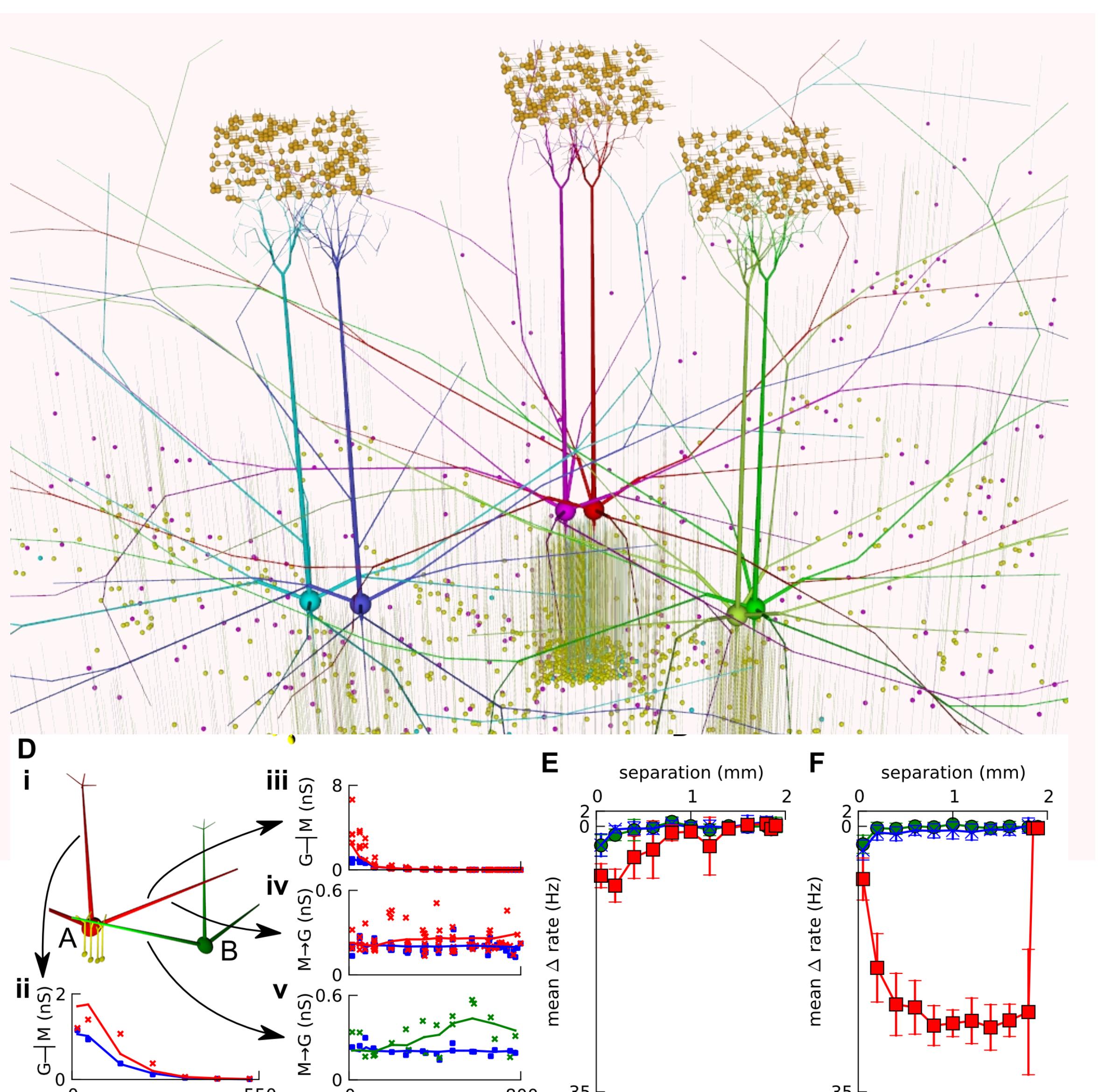


Multiscale Modeling in MOOSE

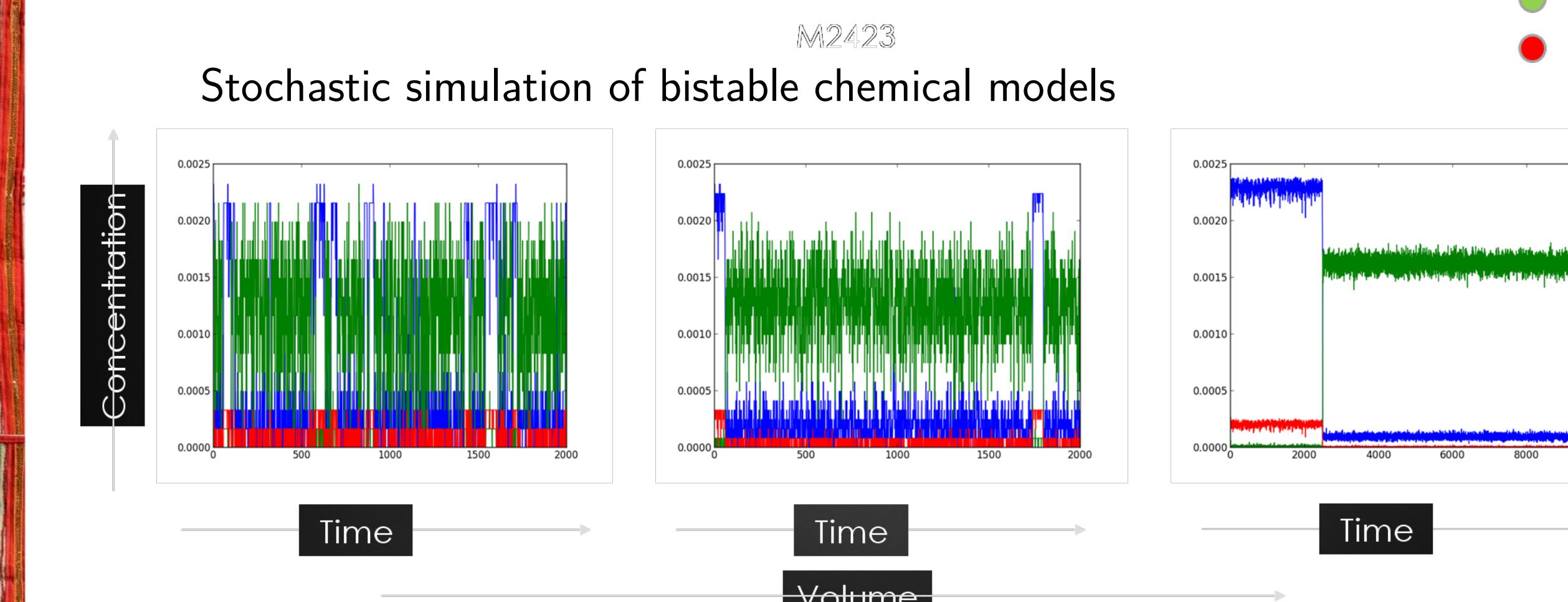
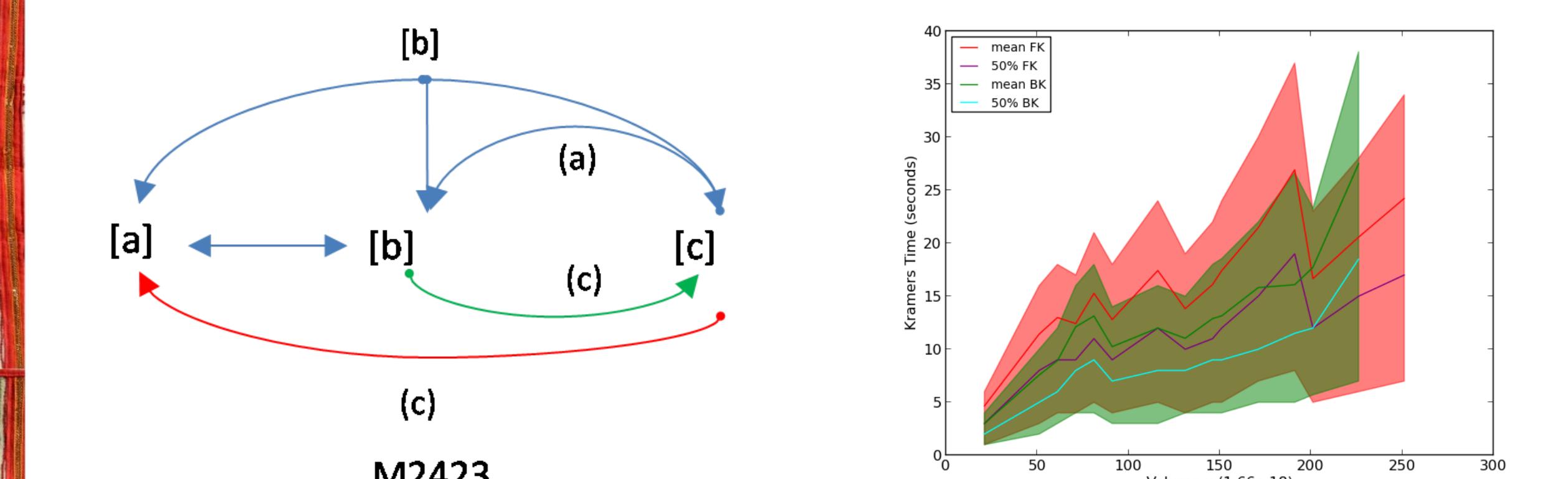
- 10^{11} cells, 10^{15} synapses, 10000? reactions per synapse
- Electrical events: < 1 ms, Chemical events: 1 sec → 1000 sec
- Structural events: 100 sec → months



Some projects using MOOSE



Robustness of Chemical Switches



Summary

- Integrate many scales of neuronal data with basic physical/chemical principles.
- Explain phenomenon of plasticity, activity and neuronal coding.
- Predict circuit mechanisms, plasticity rules, and emergent phenomena such as *decorrelation*, *robustness*, and *memory decay*.

We have developed MOOSE to carry out these simulations.

We use models to,