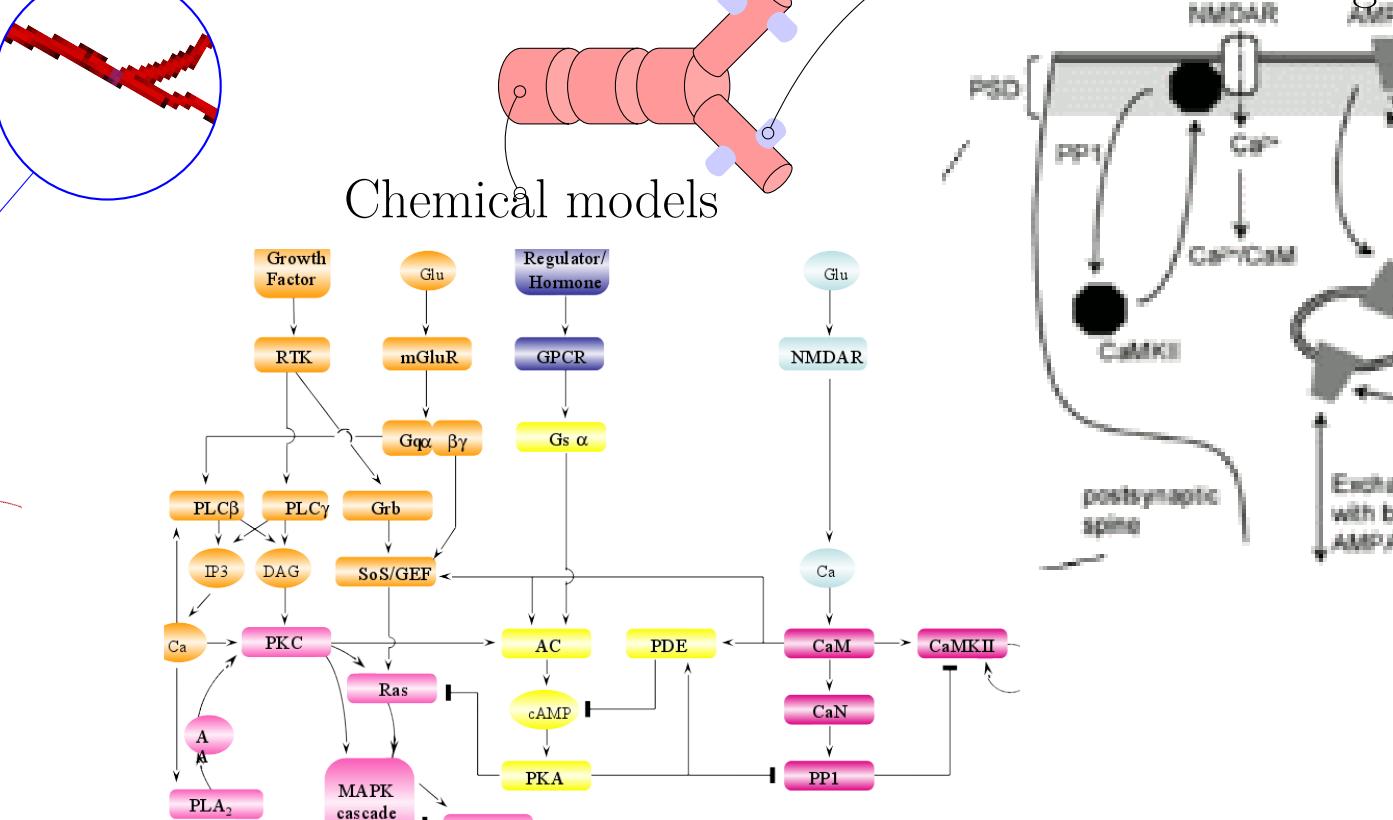
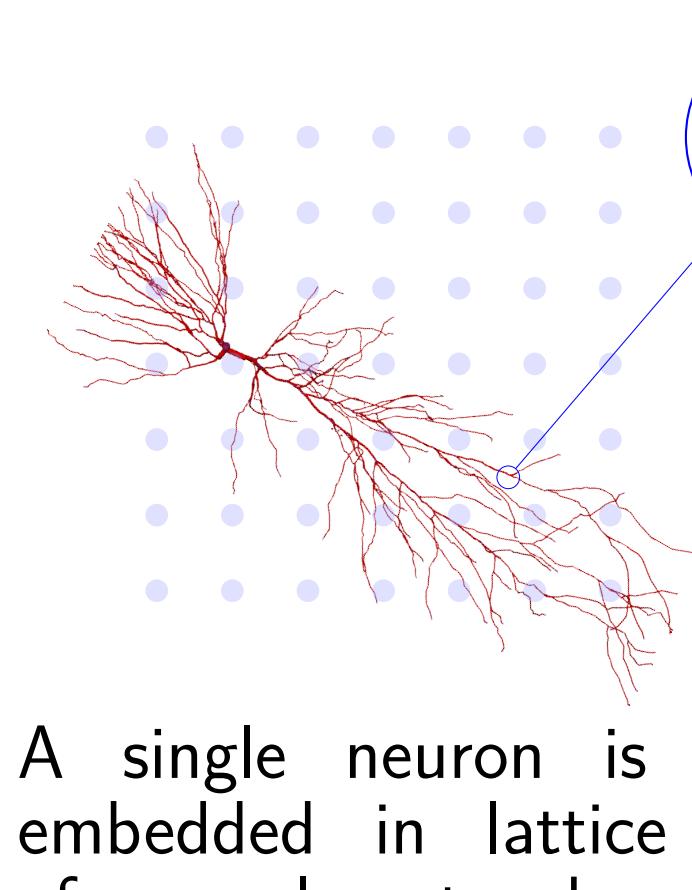


Modelling Memory Across Scale

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

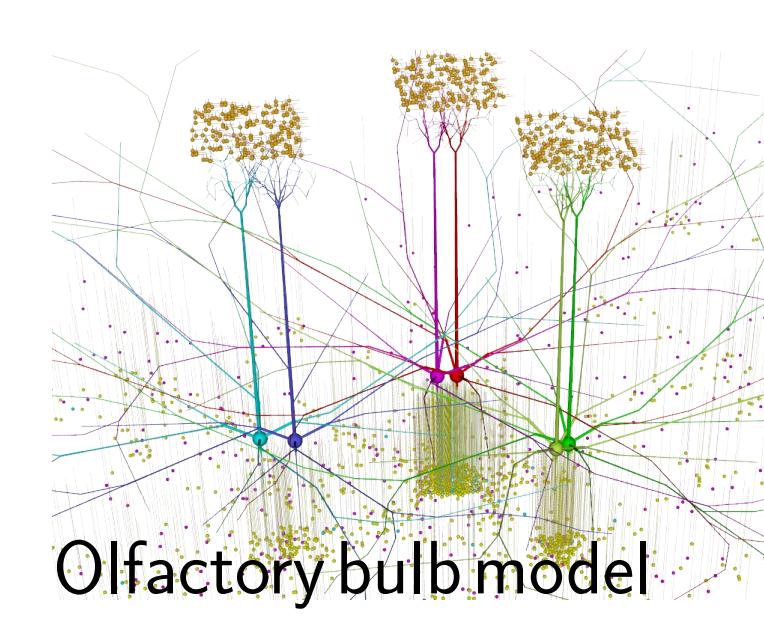
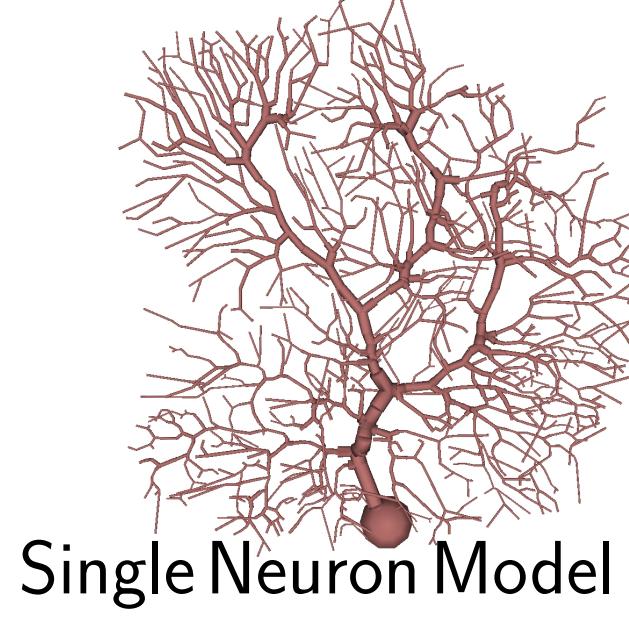
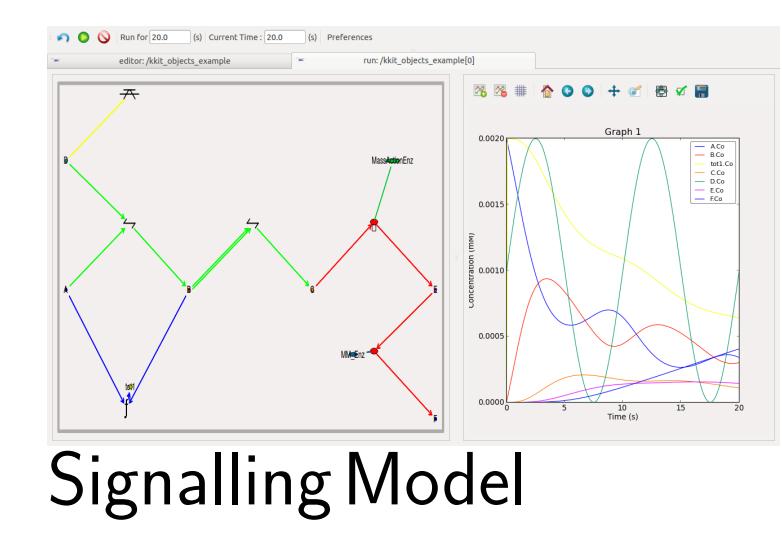
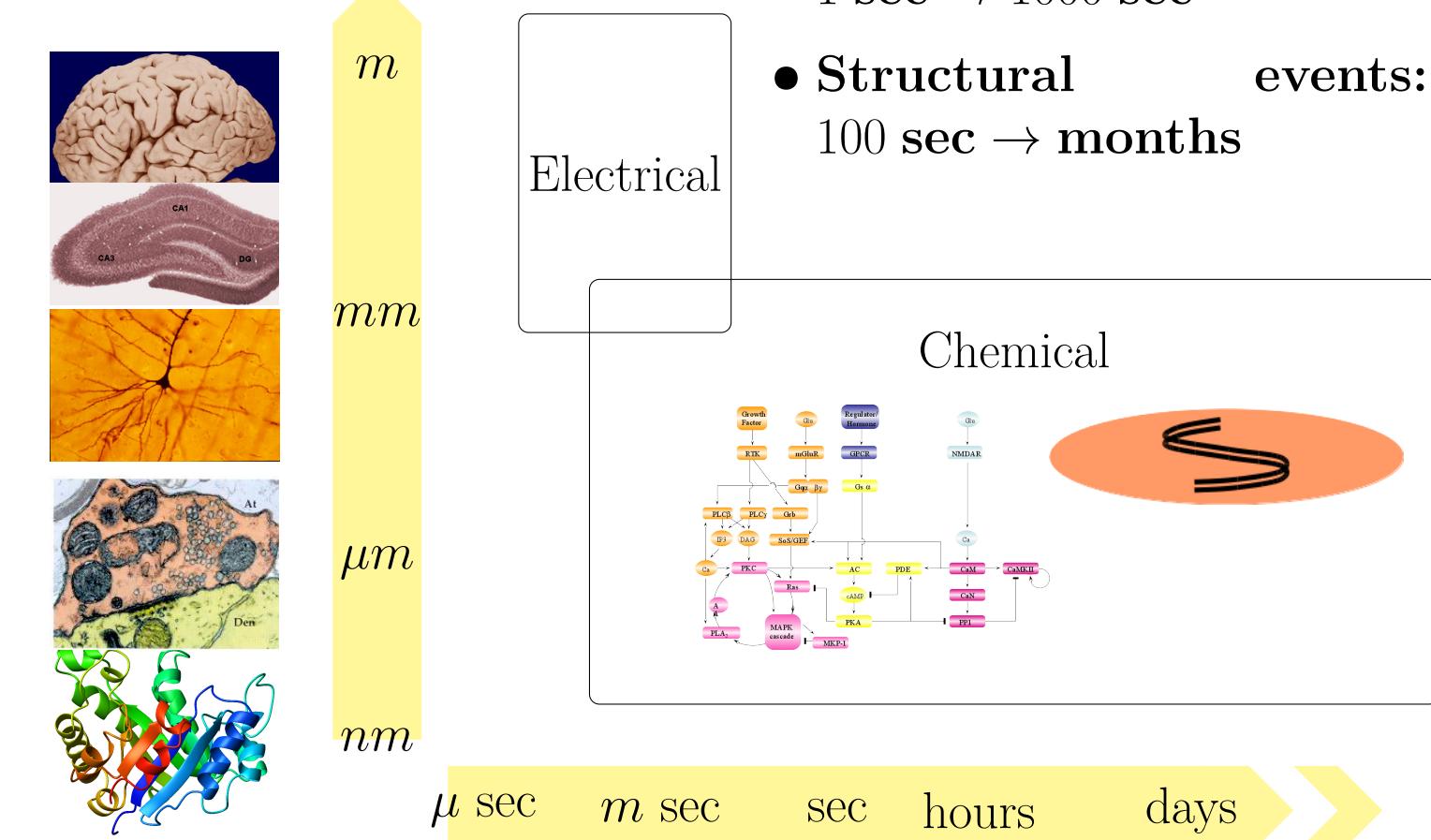
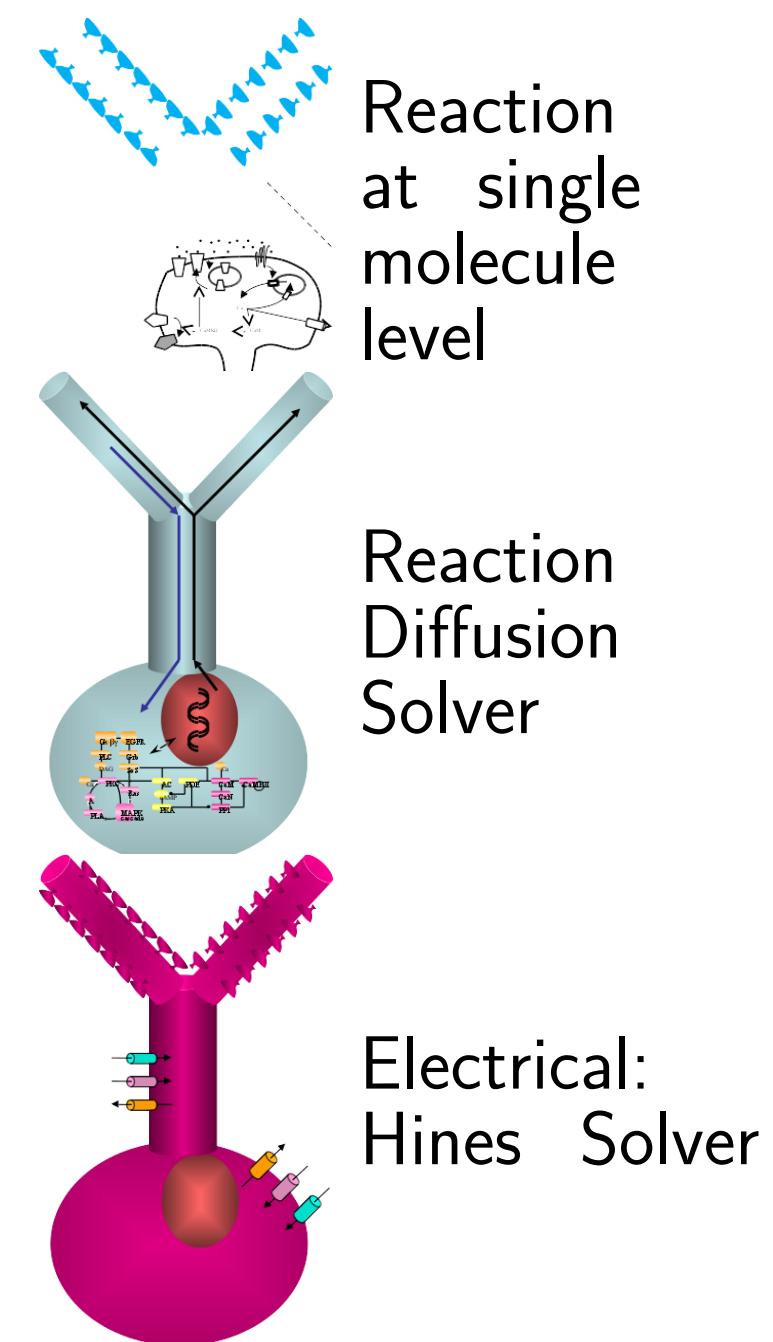
Why Multiscale?

- 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.

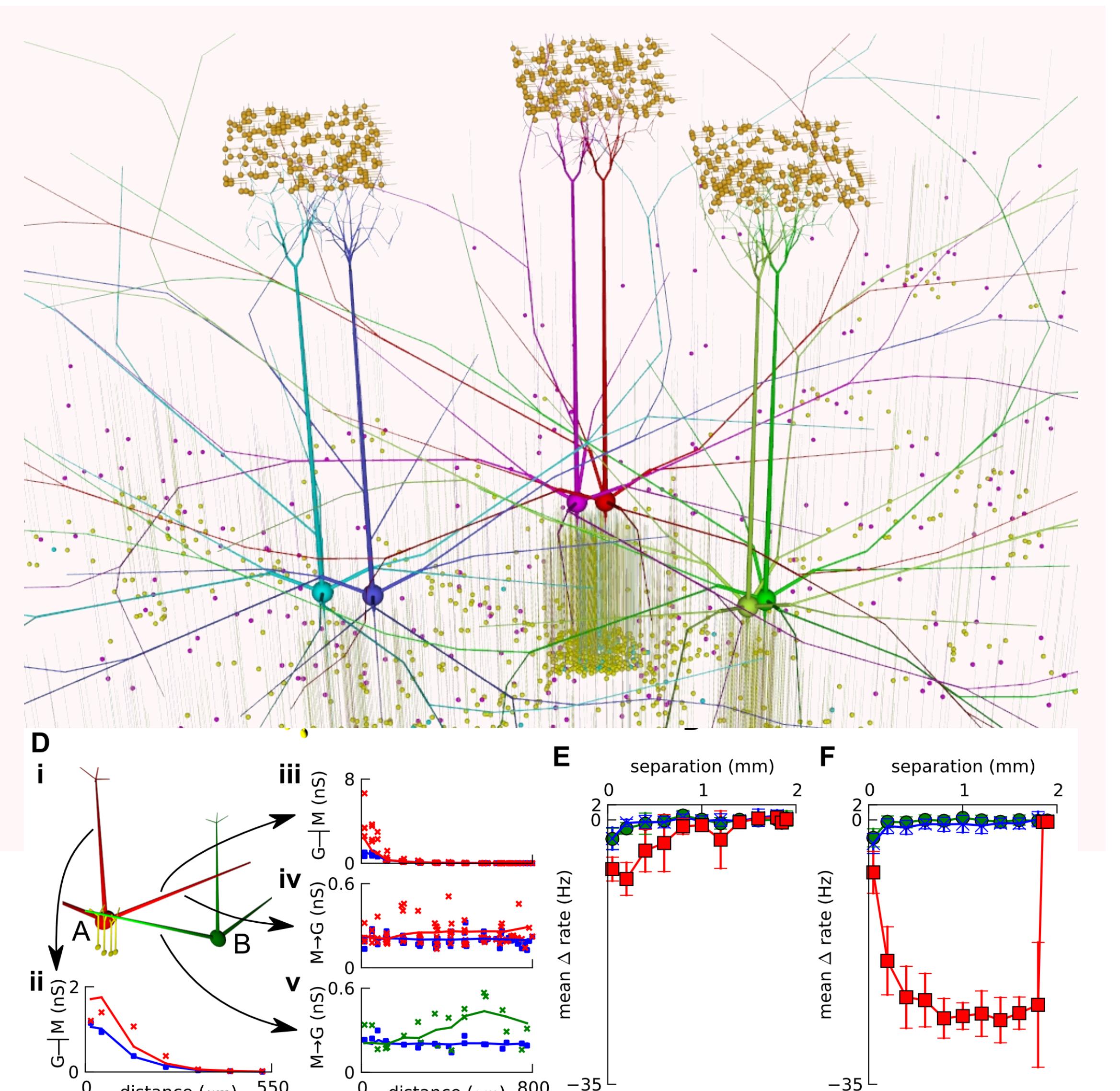


Multiscale Modeling in MOOSE

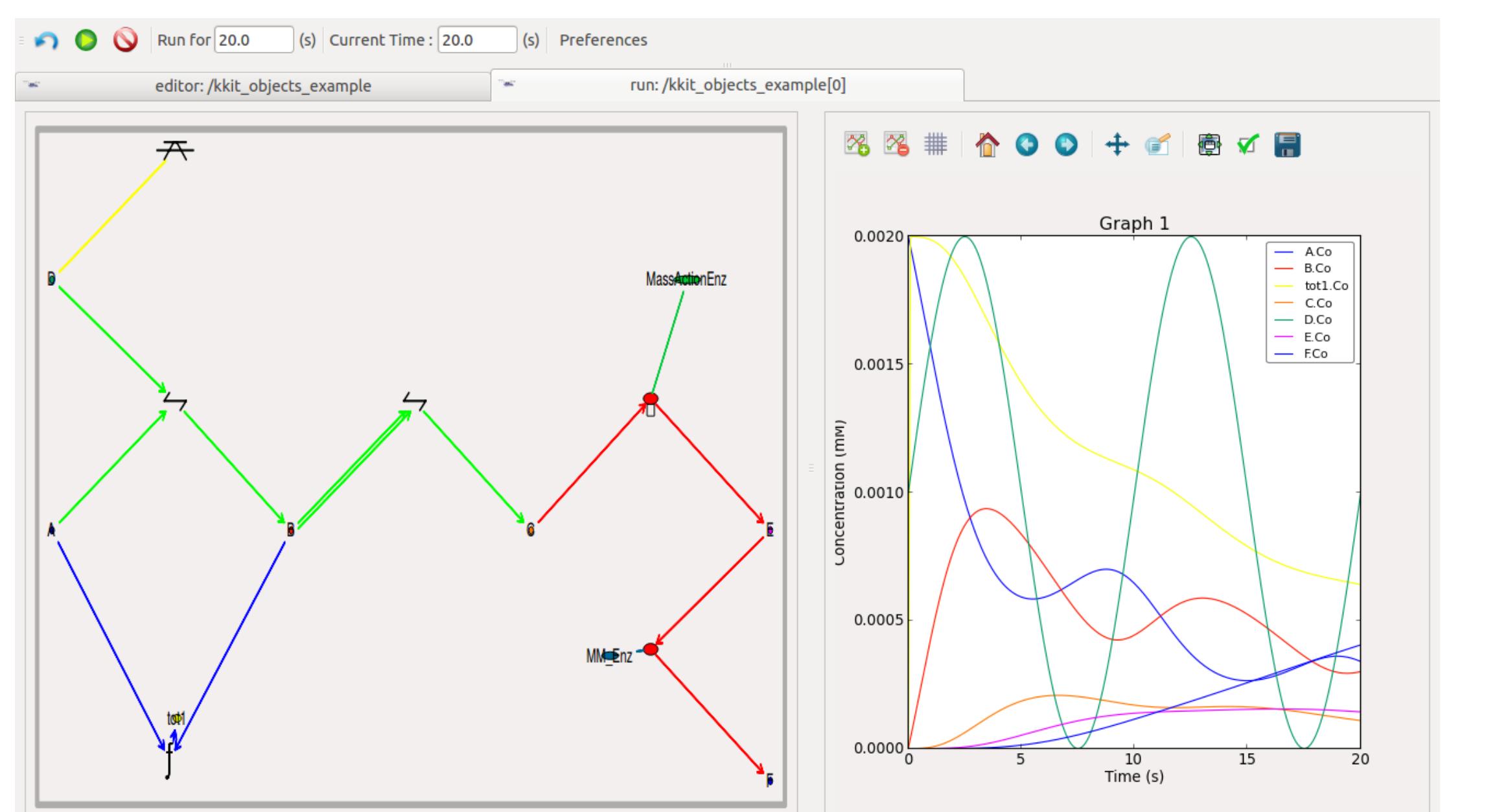
- 10^{11} cells, 10^{15} synapses, 10000? reactions per synapse
- Electrical events: < 1 ms, Chemical events: 1 sec \rightarrow 1000 sec
- Structural events: 100 sec \rightarrow months



Some projects using MOOSE

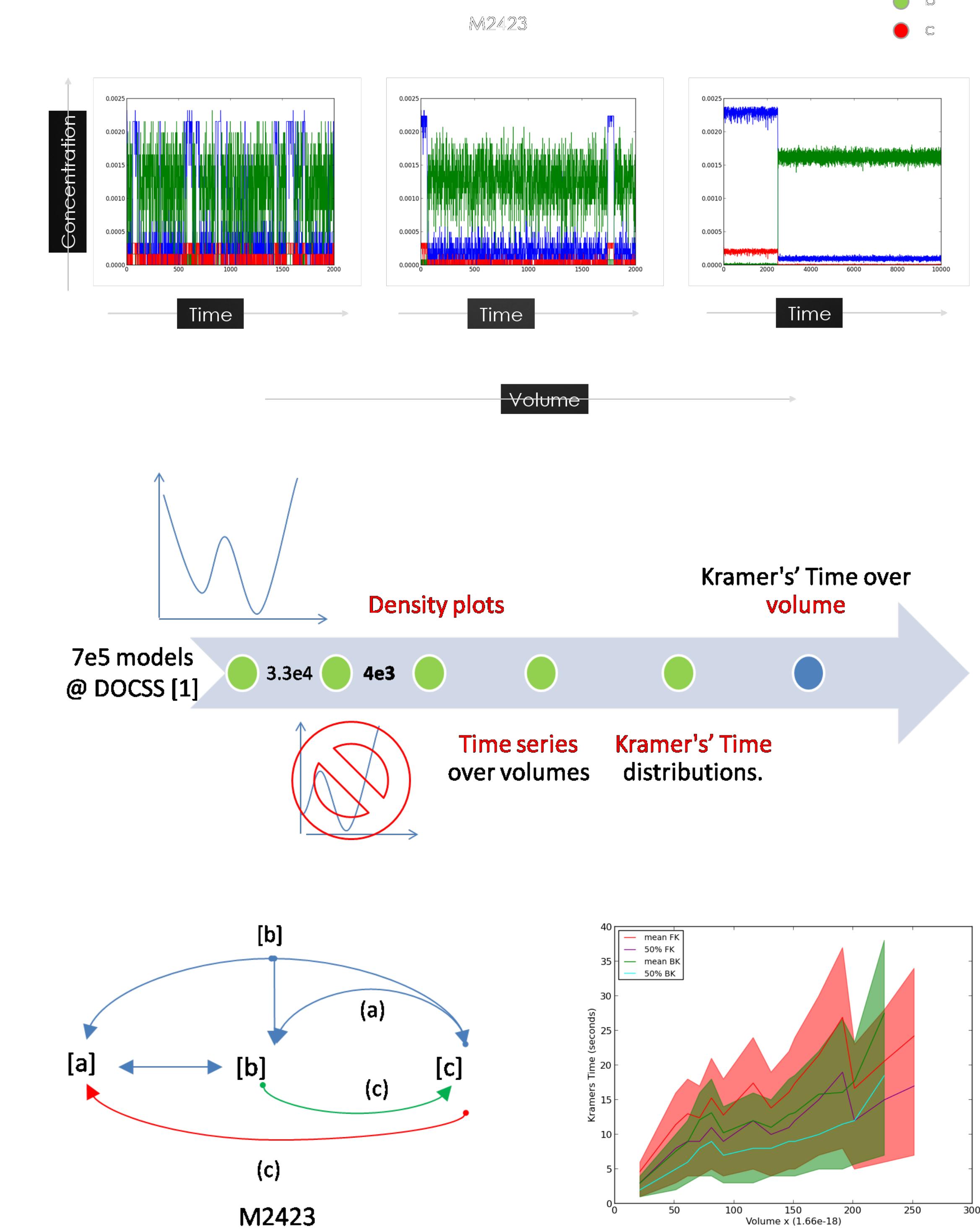


Network coding and computation in olfaction and sematosensory cortex. It explains linear coding and phase-decorrelation and predicts connectivity, lateral dendrite output structure.



Robustness of chemical switches with respect to stochasticity and parameters.

Sahil



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.