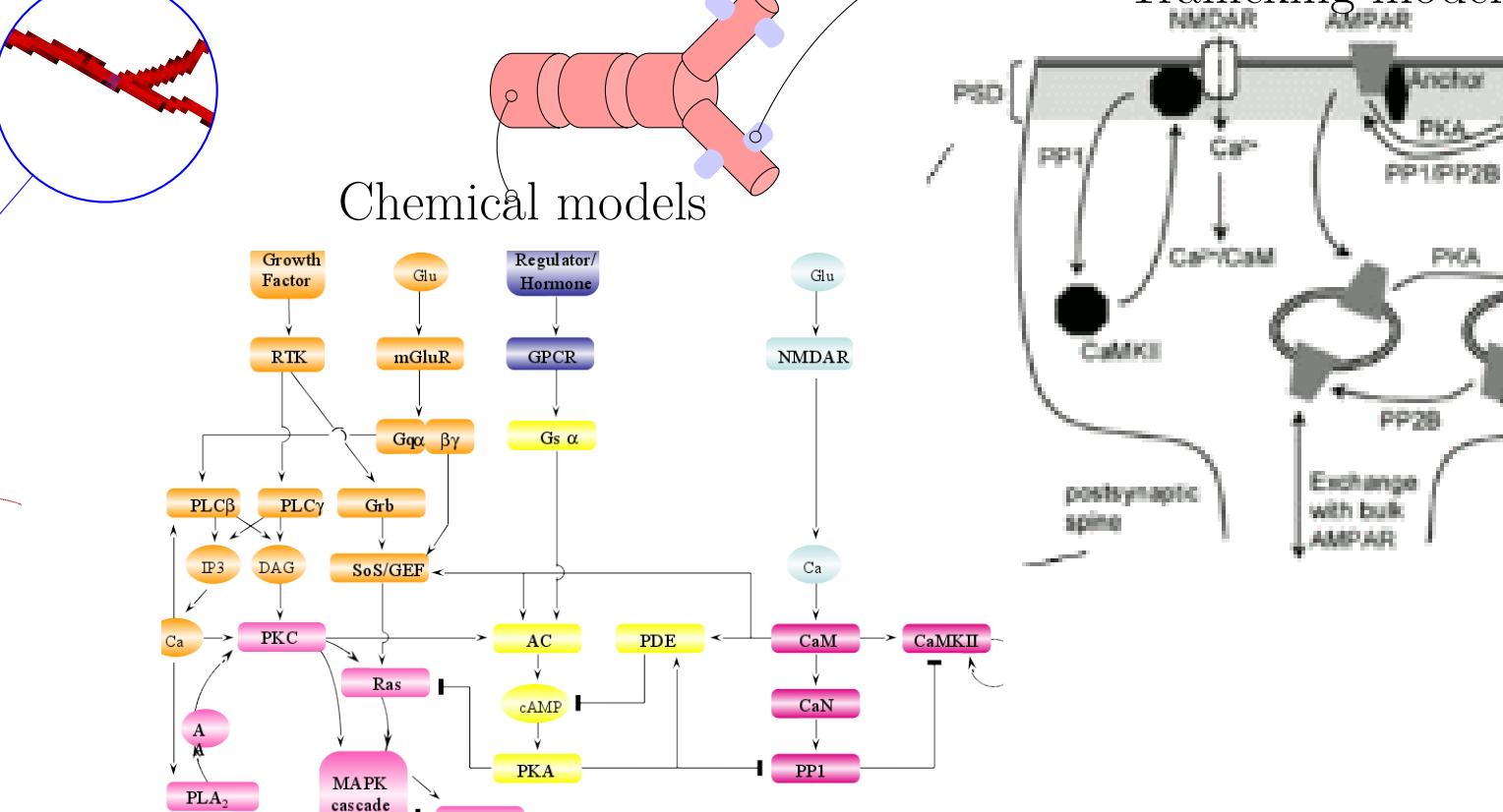
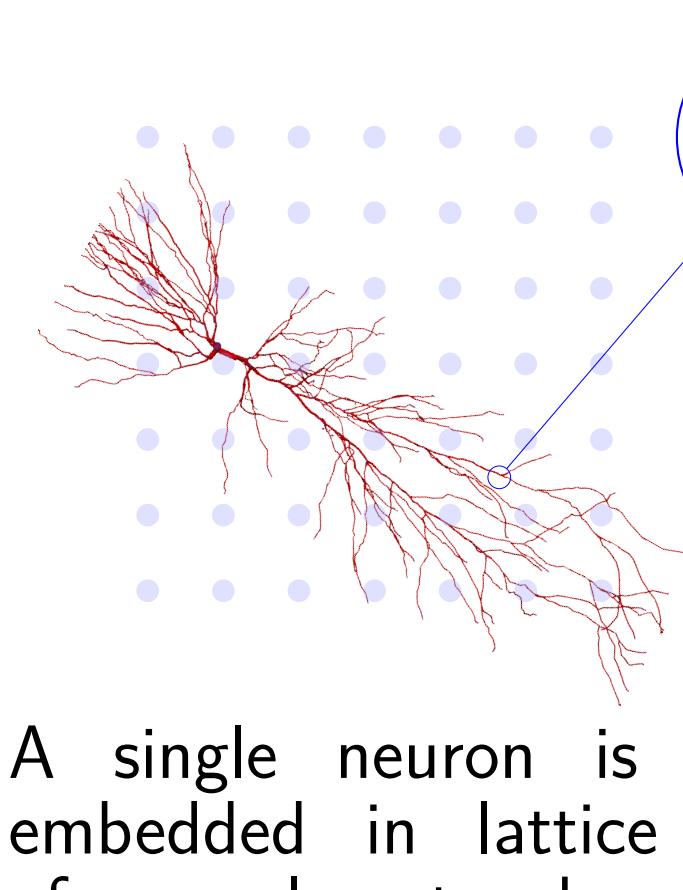


# Modelling Memory Across Scale

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

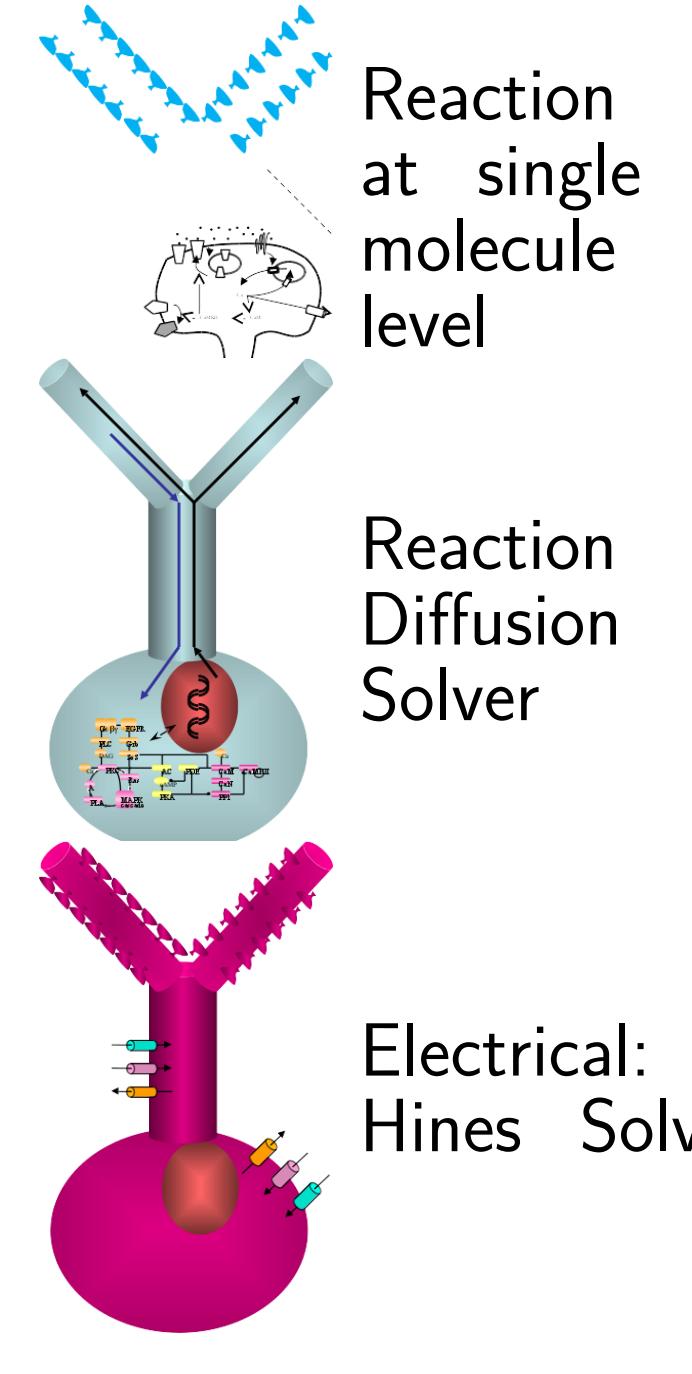
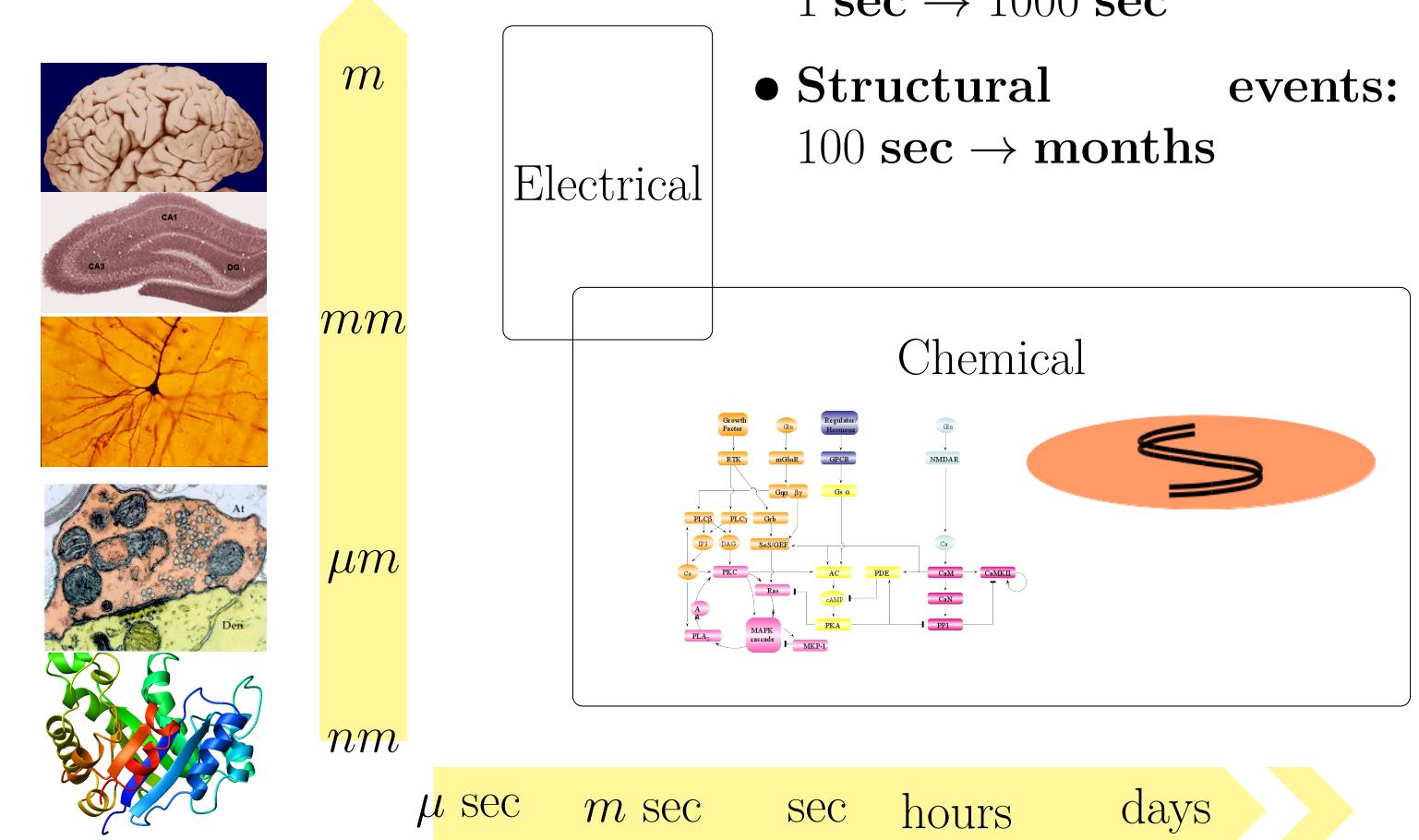
## Why Multiscale?

- 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.

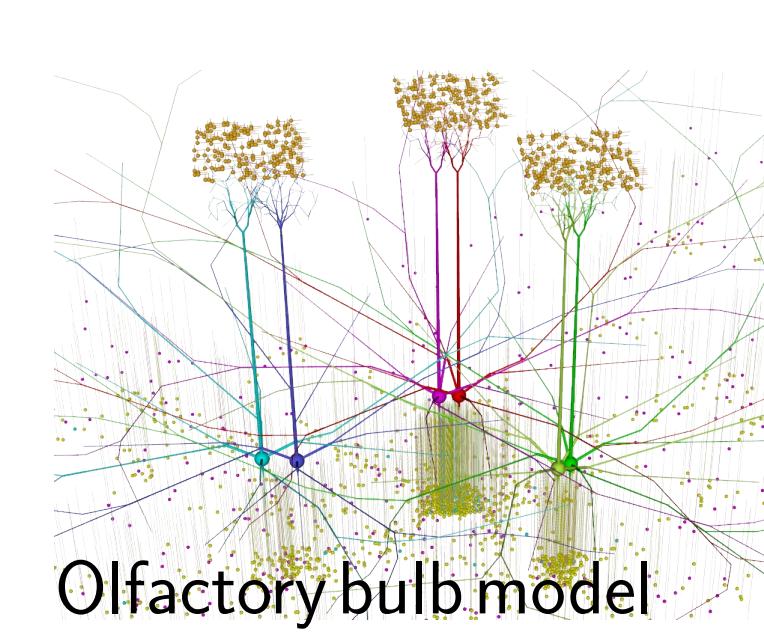
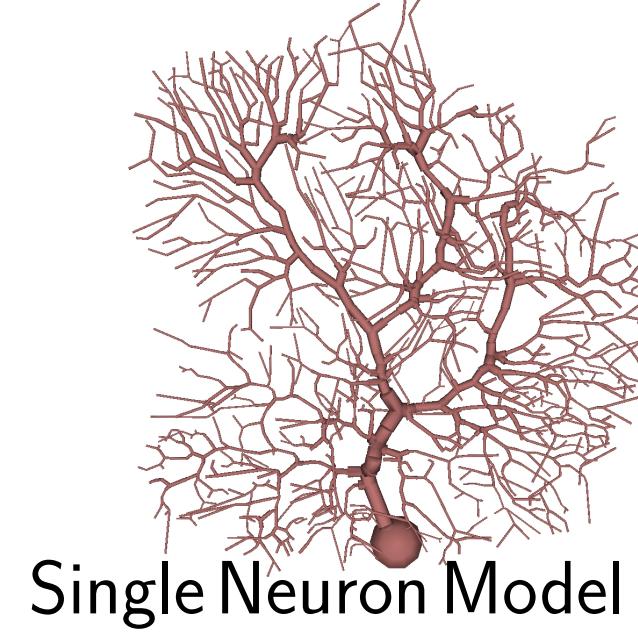
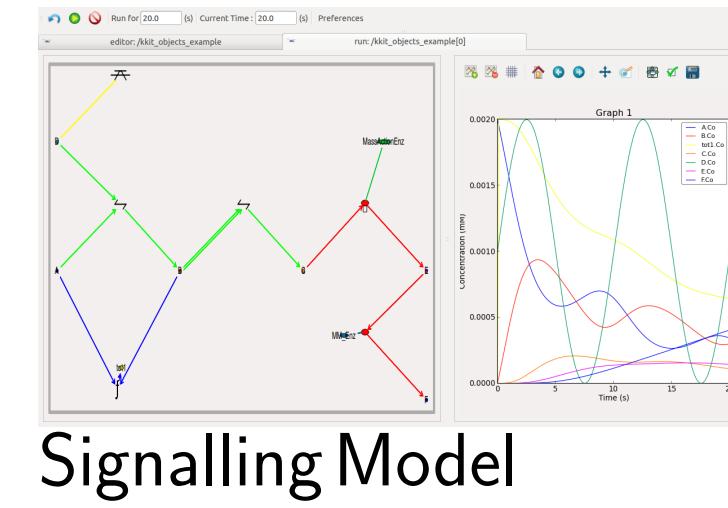
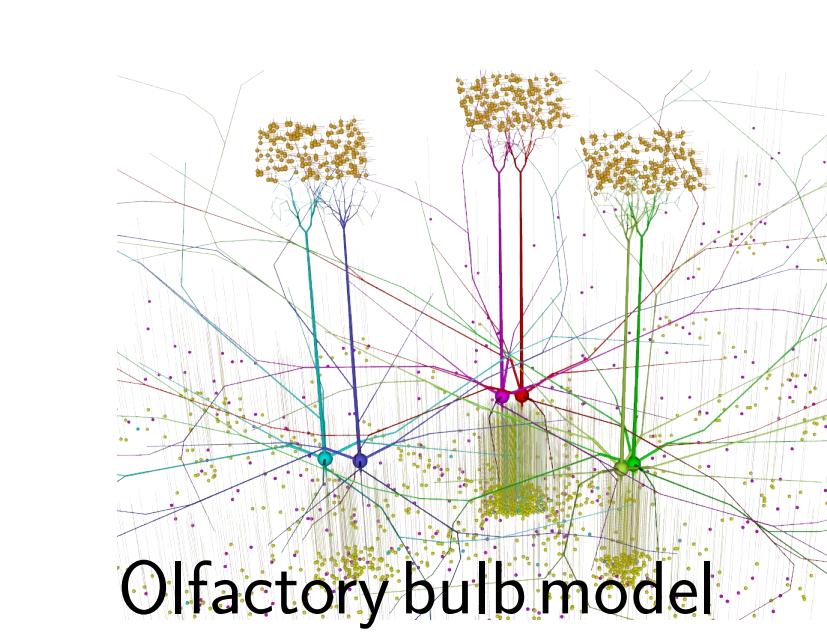


## Multiscale Modeling in MOOSE

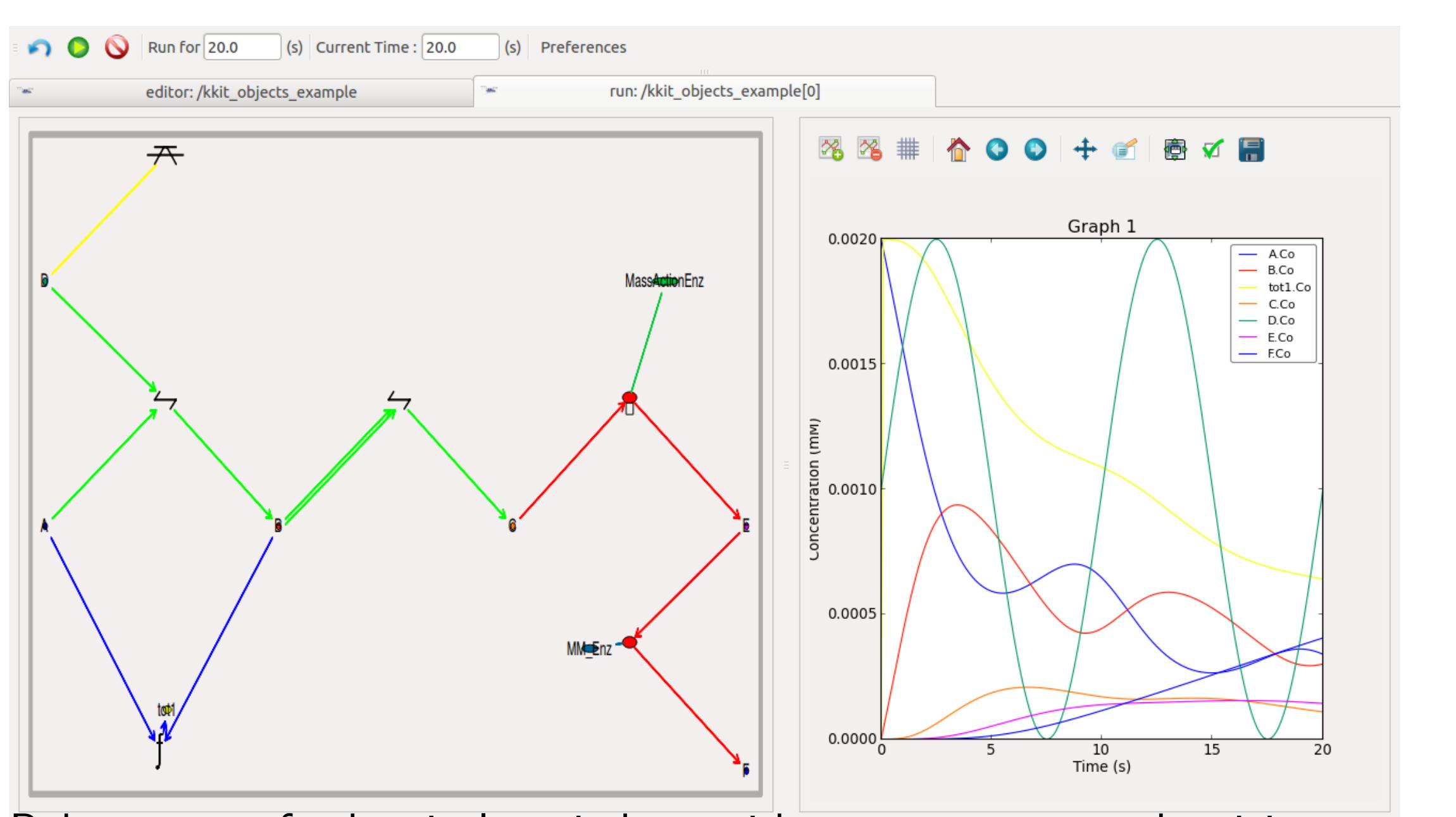
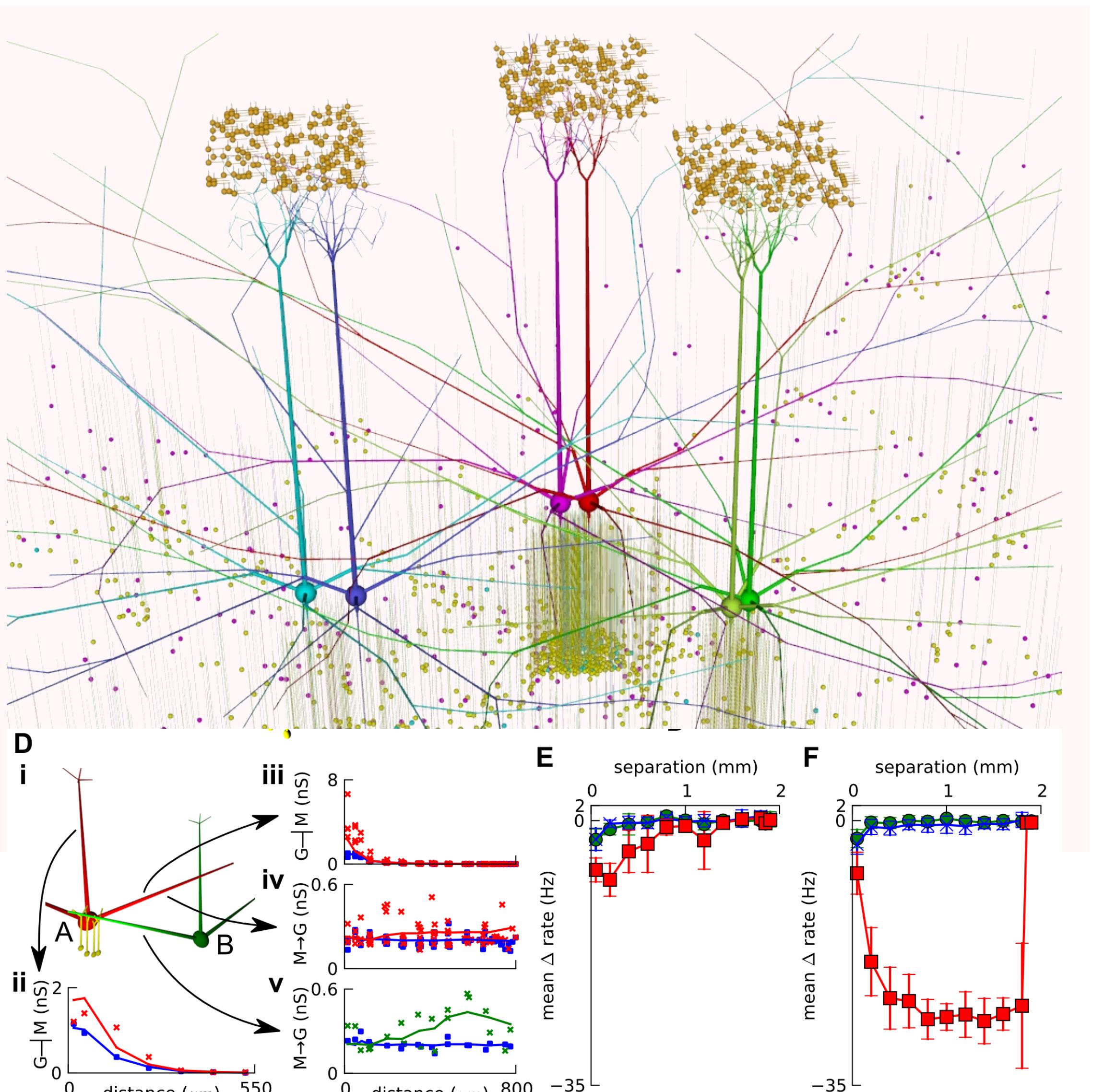
- $10^{11}$  cells,  $10^{15}$  synapses, 10000? reactions per synapse
- Electrical events: < 1 ms, Chemical events: 1 sec  $\rightarrow$  1000 sec
- Structural events: 100 sec  $\rightarrow$  months



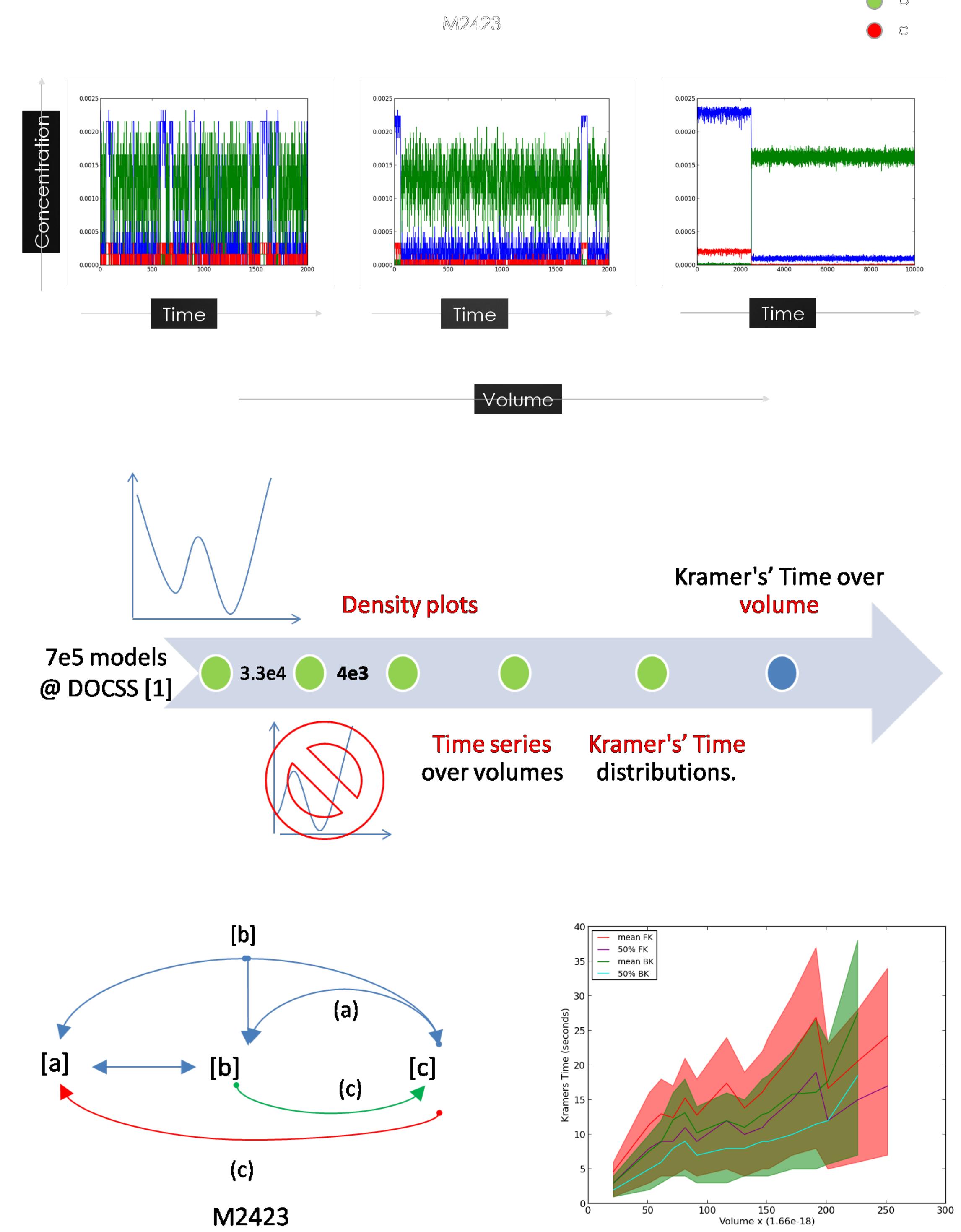
Reaction Diffusion Solver



## Some projects using MOOSE



## Sahil



## Summary

- We use models to
- 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.