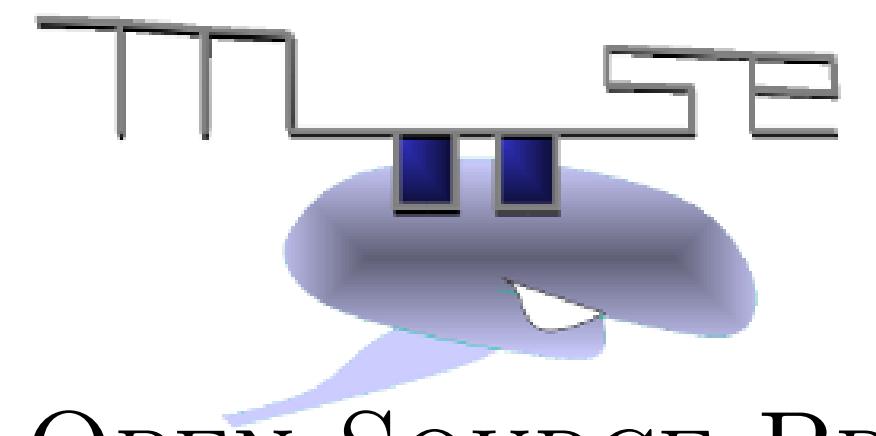


Modelling Memory Across Scales

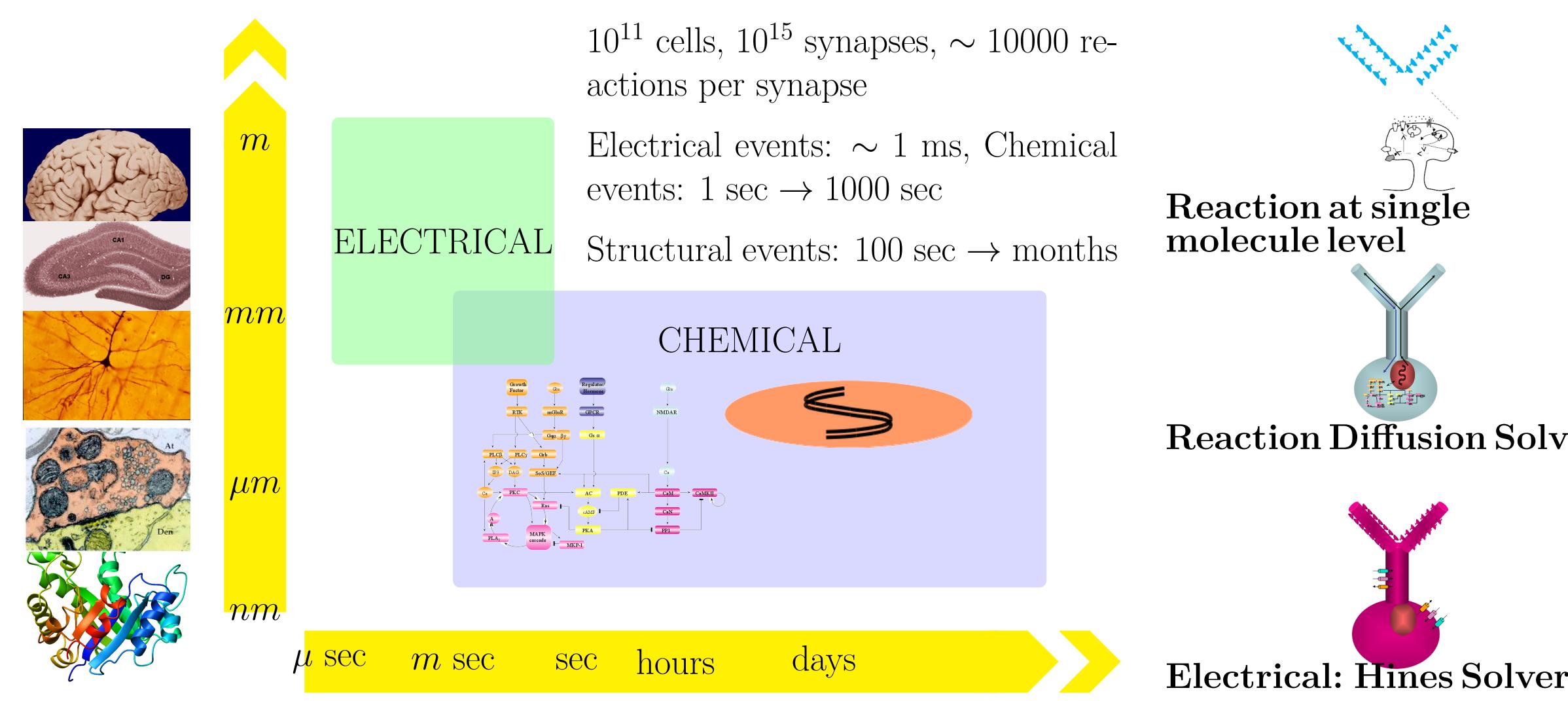
Subhasis Ray, Harsha Rani, Aditya Gilra, Sahil Moza, Aviral Goel, Dilawar Singh, Upinder Bhalla



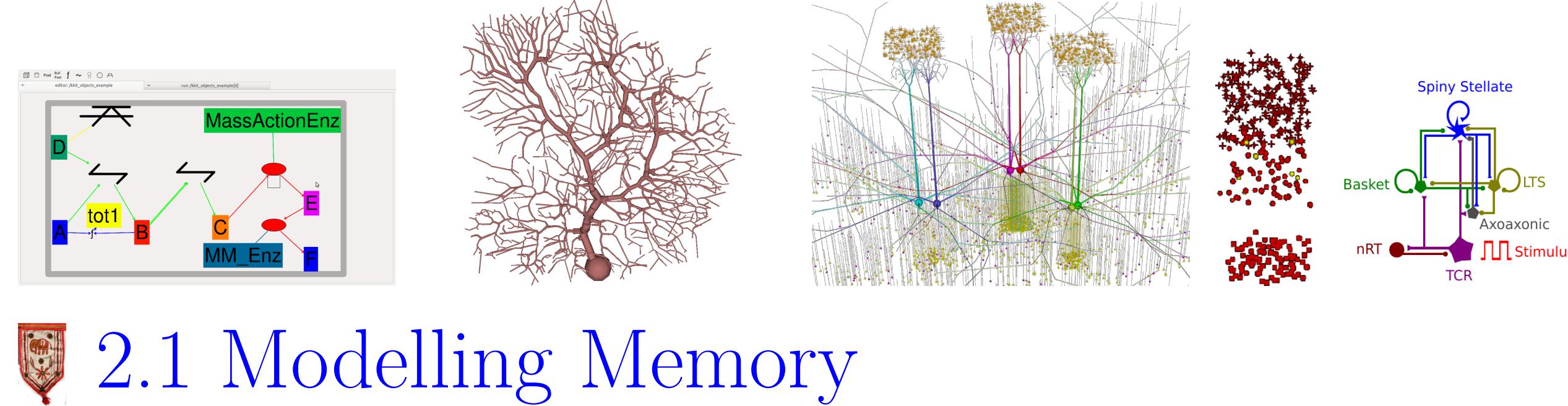
AN OPEN-SOURCE PROJECT

1. Why Multiscale?

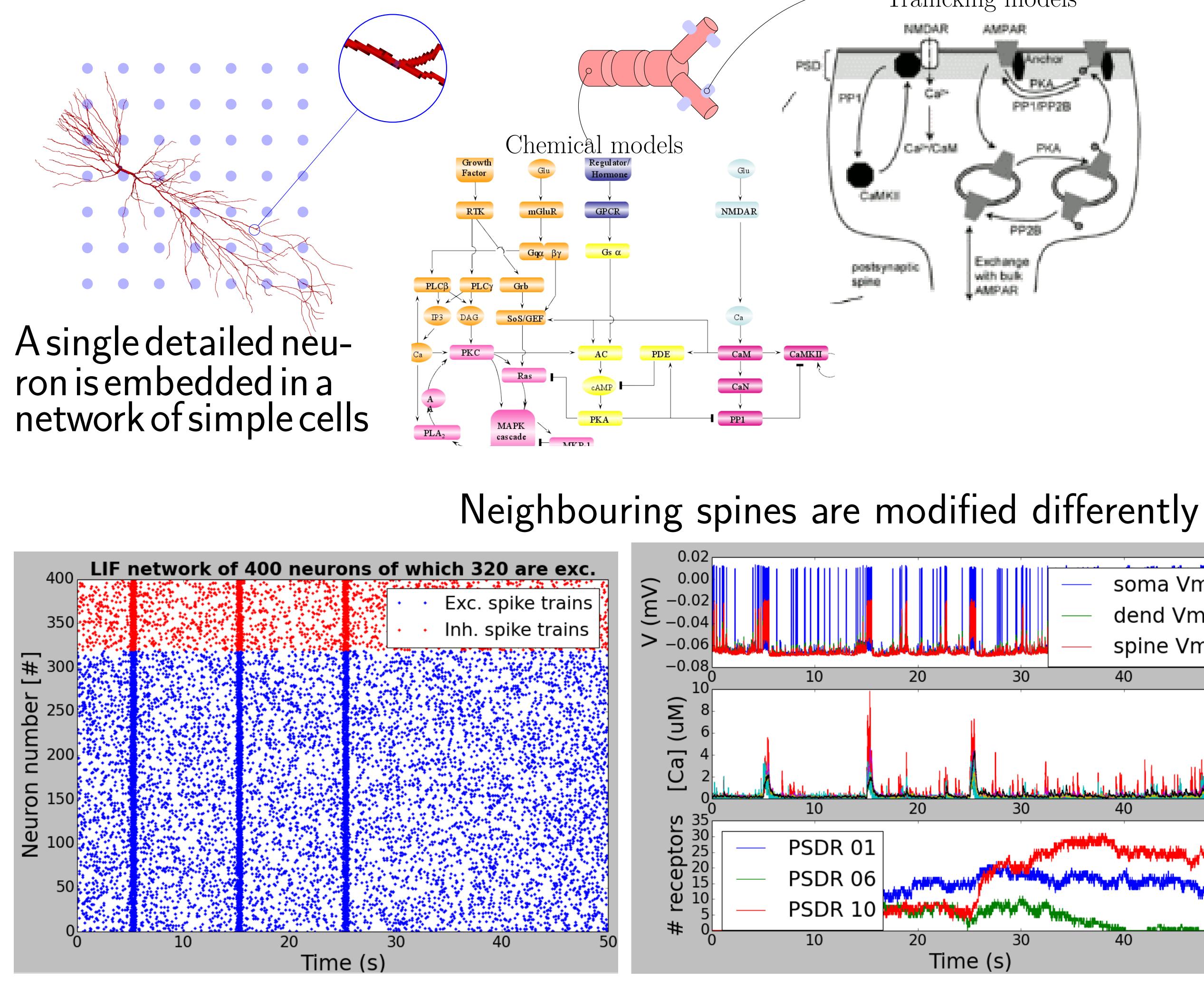
- Memory and plasticity involve brain mechanisms from molecular scale to enormous networks.
- We have developed MOOSE: Multiscale Object Oriented Simulation Environment, to model plasticity and brain computation across scales.



2. Some projects using MOOSE



2.1 Modelling Memory



2.2 Modelling Olfactory Bulb

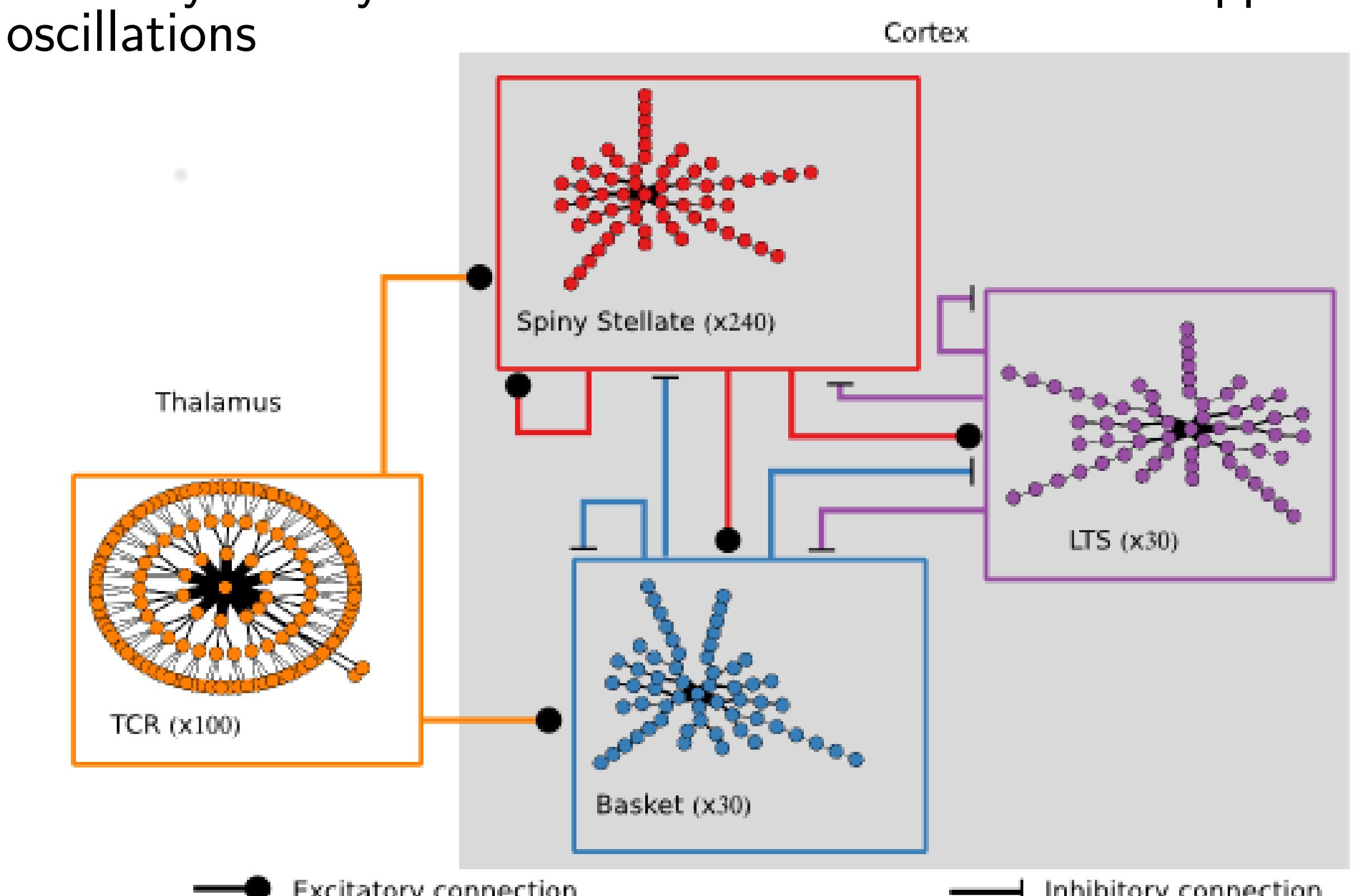


The bulb model explains linear coding and phase-decorrelation and predicts connectivity, lateral dendrite output structure.

2.3 Modelling Cortex

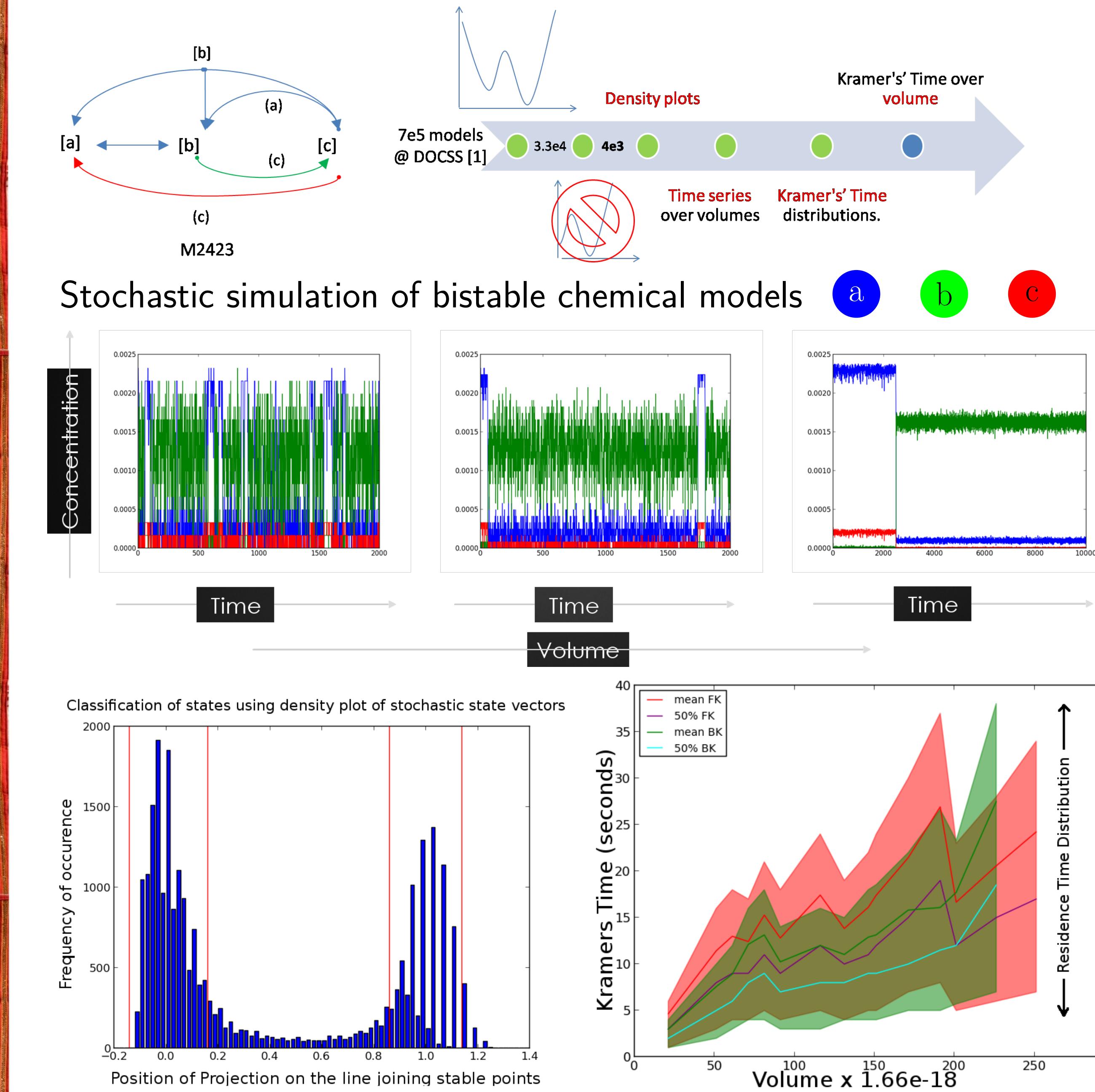
Predicts:

- Excitatory-Inhibitory balance needed to avoid strongly oscillatory behaviour
- Many weakly connected basket cells better at suppressing oscillations

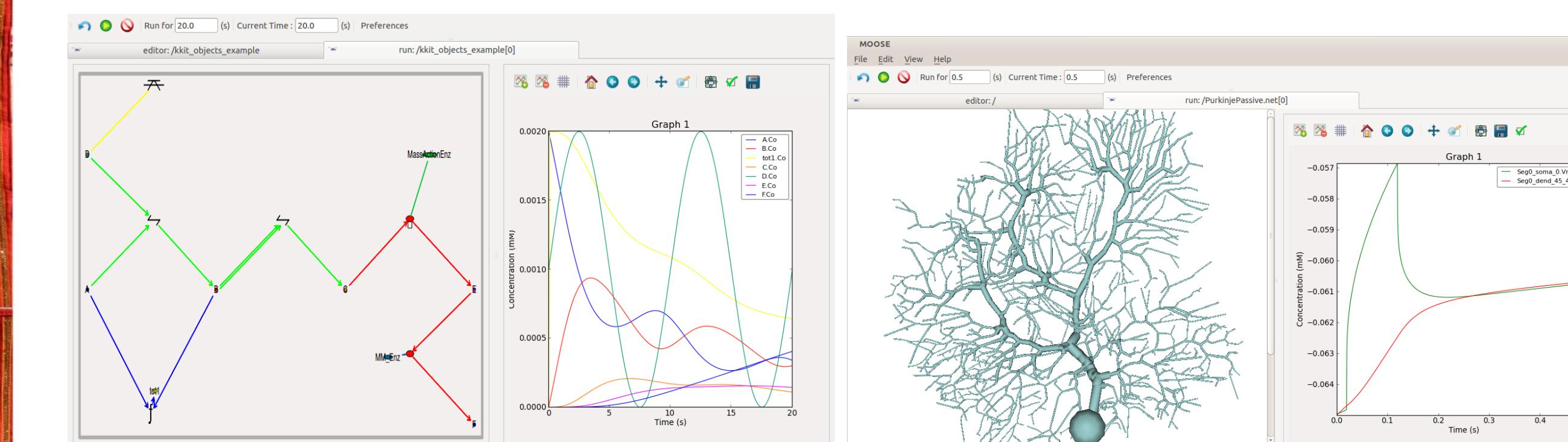


2.4 Robustness of Chemical Switches

Does parameter robustness imply noise robustness?



2.5 GUI for Chemical and Electrical Models



3. Summary

We use models to:

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