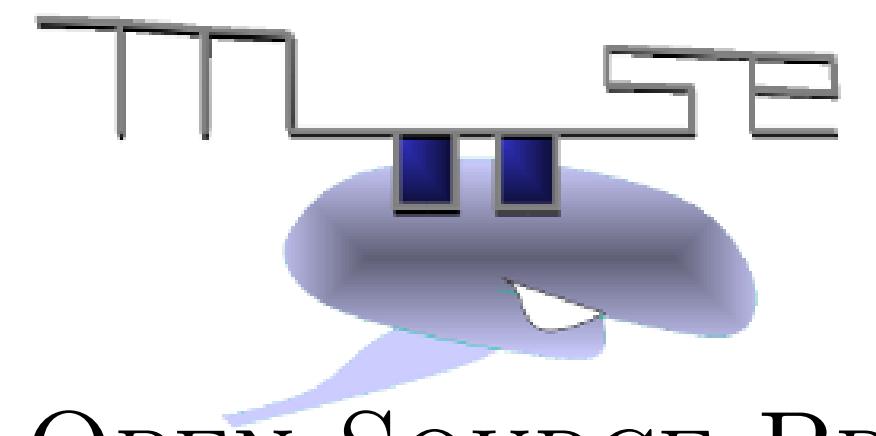


# Modelling Memory Across Scales

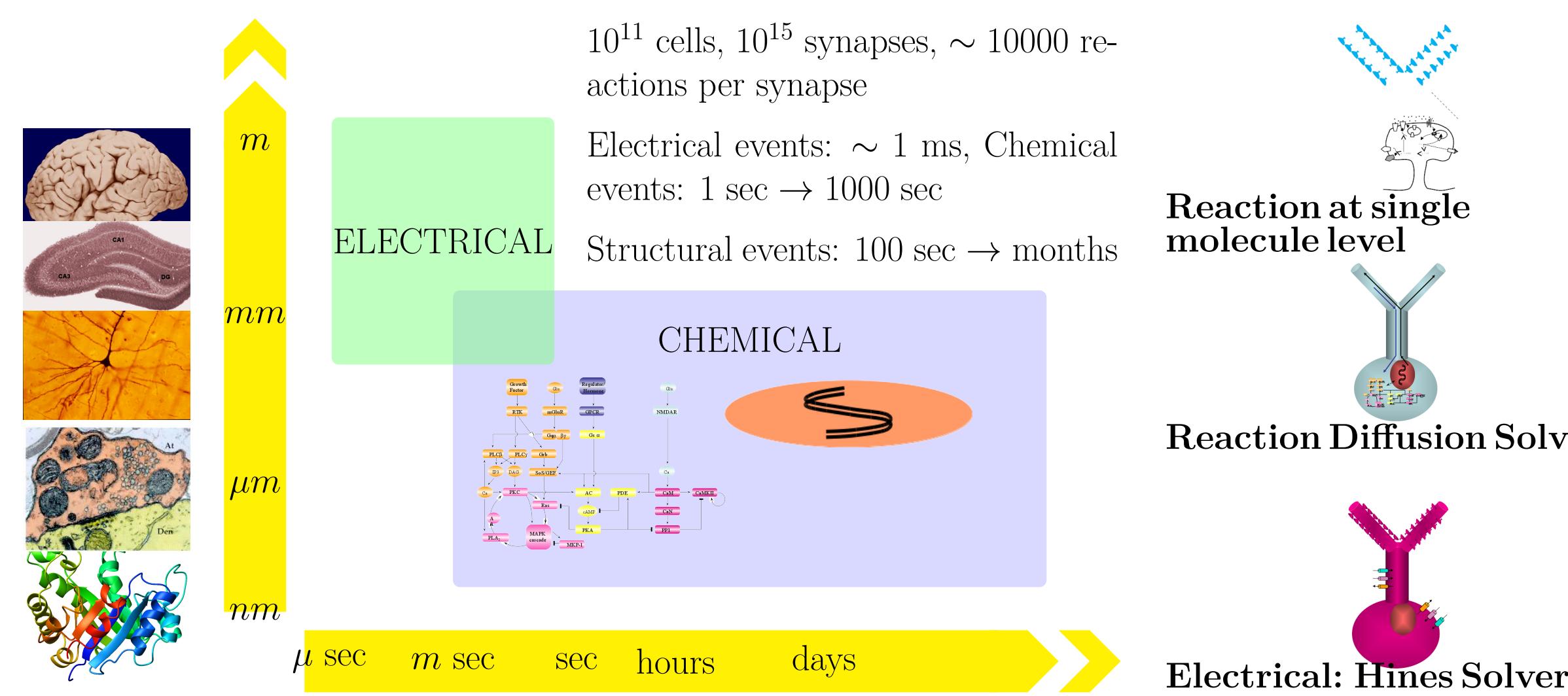
Subhasis Ray, Harsha Rani, Aditya Gilra, Sahil Moza, Aviral Goel, Dilawar Singh, Upinder Bhalla



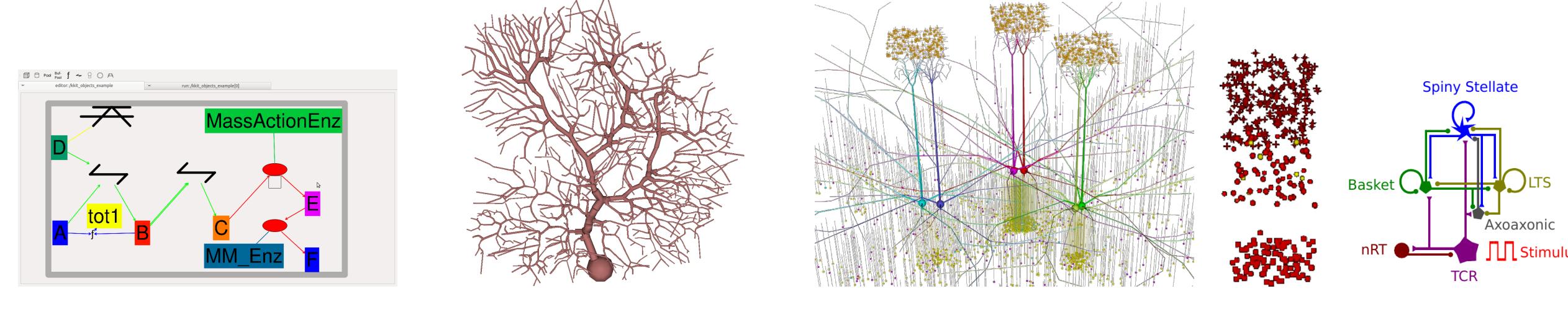
AN OPEN-SOURCE PROJECT

## 1. Why Multiscale?

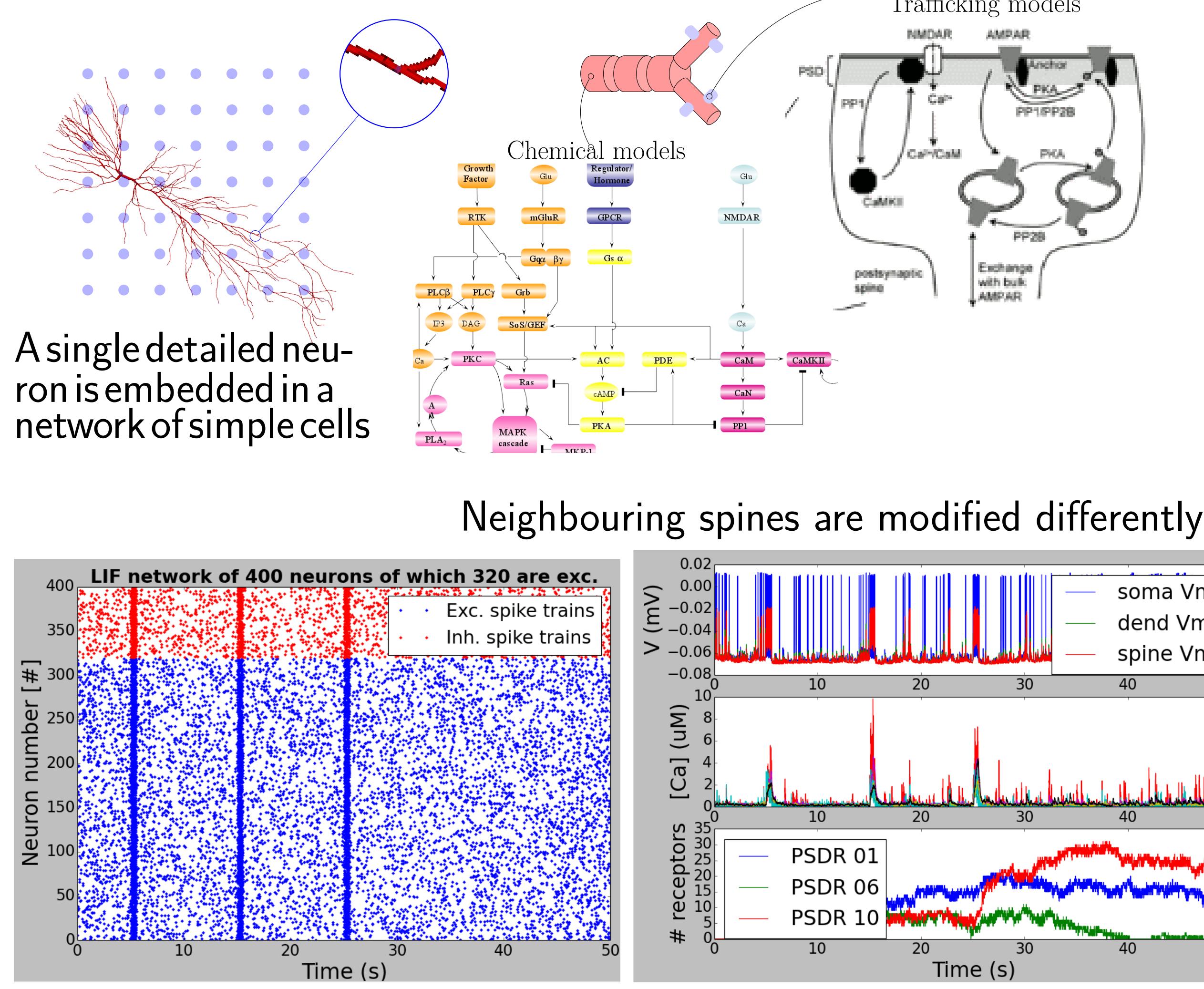
- Memory and plasticity involve brain mechanisms from molecular scale to enormous networks.
- We have developed MOOSE: Multiscale Object Oriented Simulation Environment, to model plasticity and brain computation across scales.



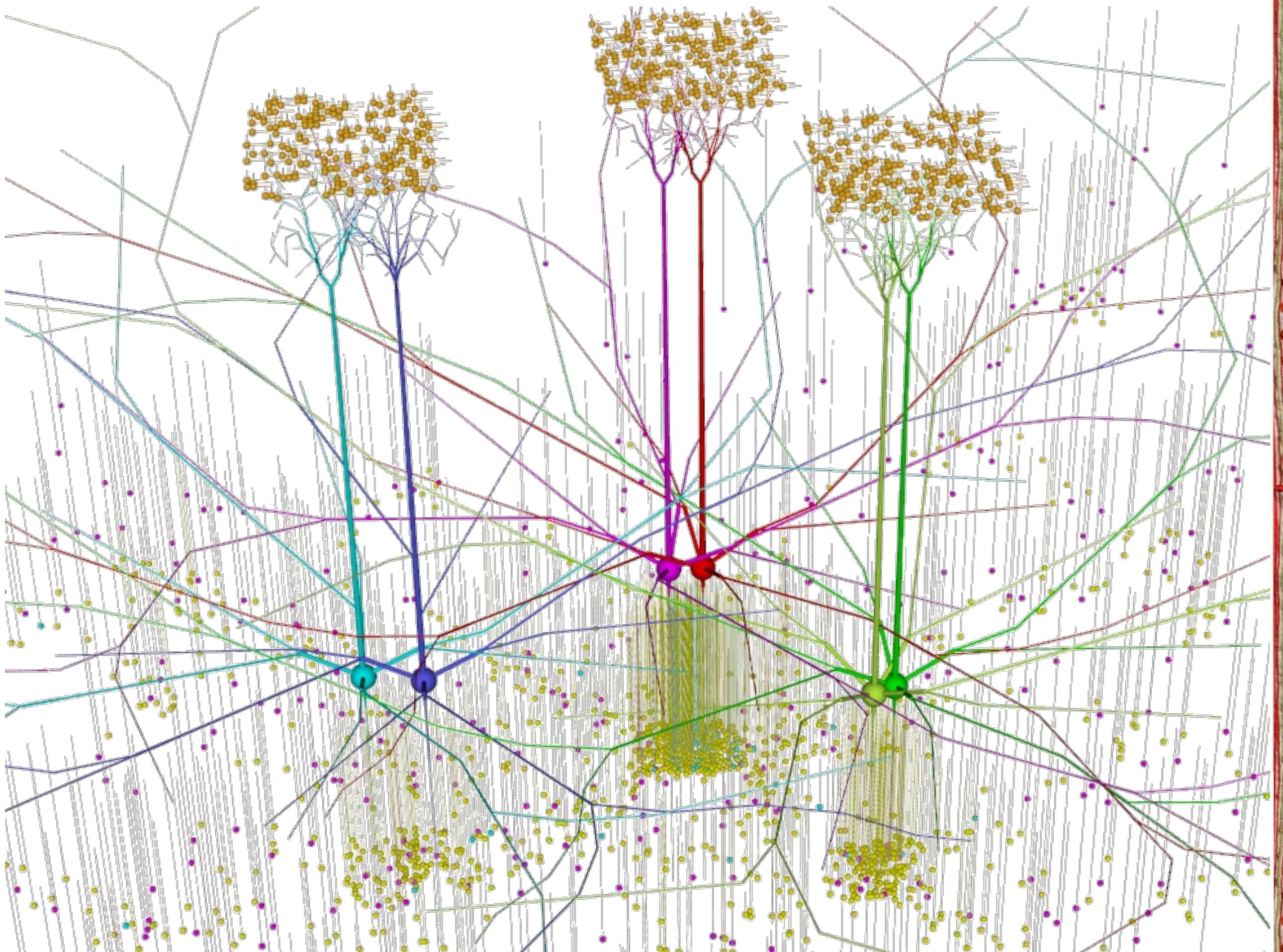
## 2. Some projects using MOOSE



### 2.1 Modelling Memory



### 2.2 Modelling Olfactory Bulb

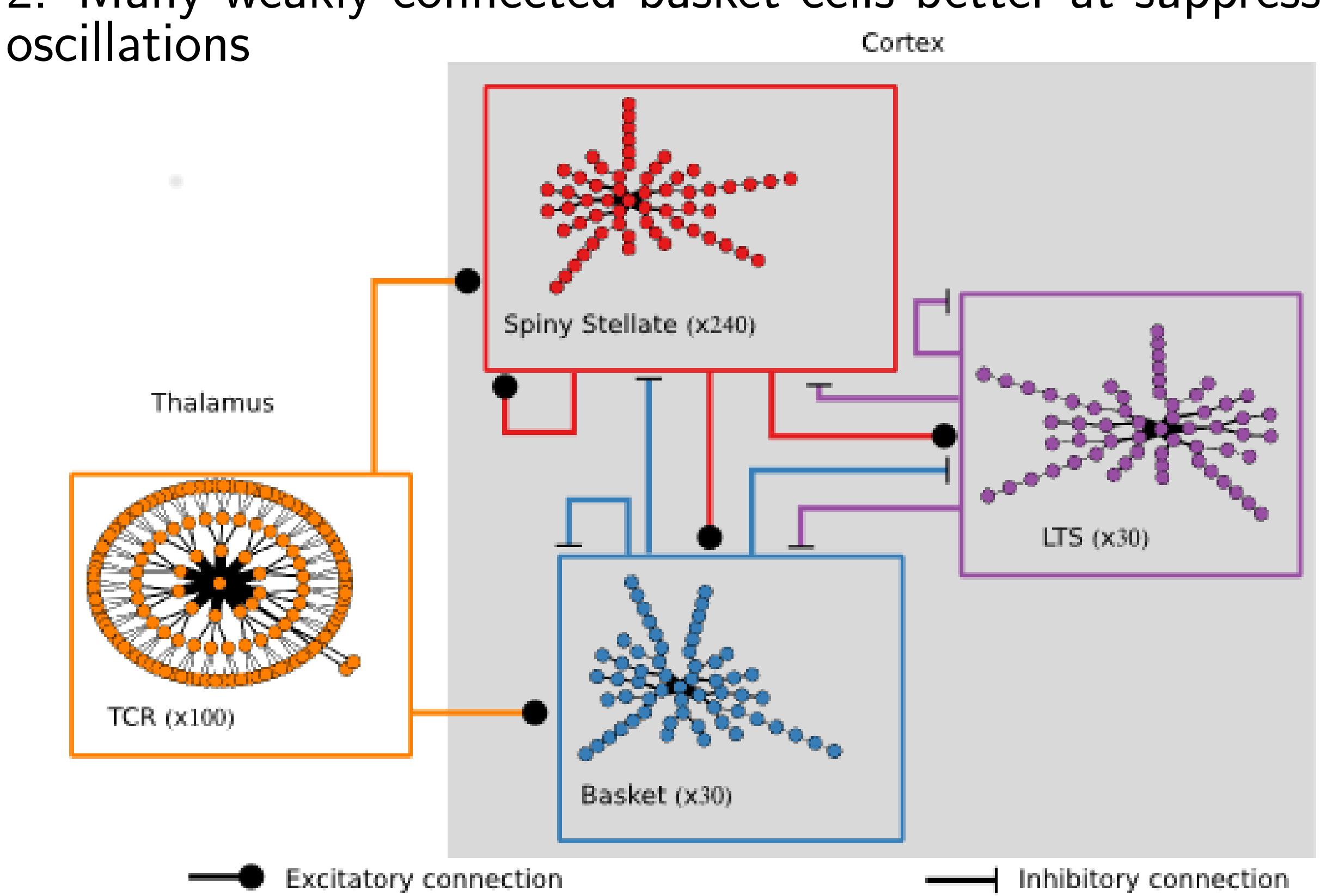


The bulb model explains linear coding and phase-decorrelation and predicts connectivity, lateral dendrite output structure.

### 2.3 Modelling Cortex

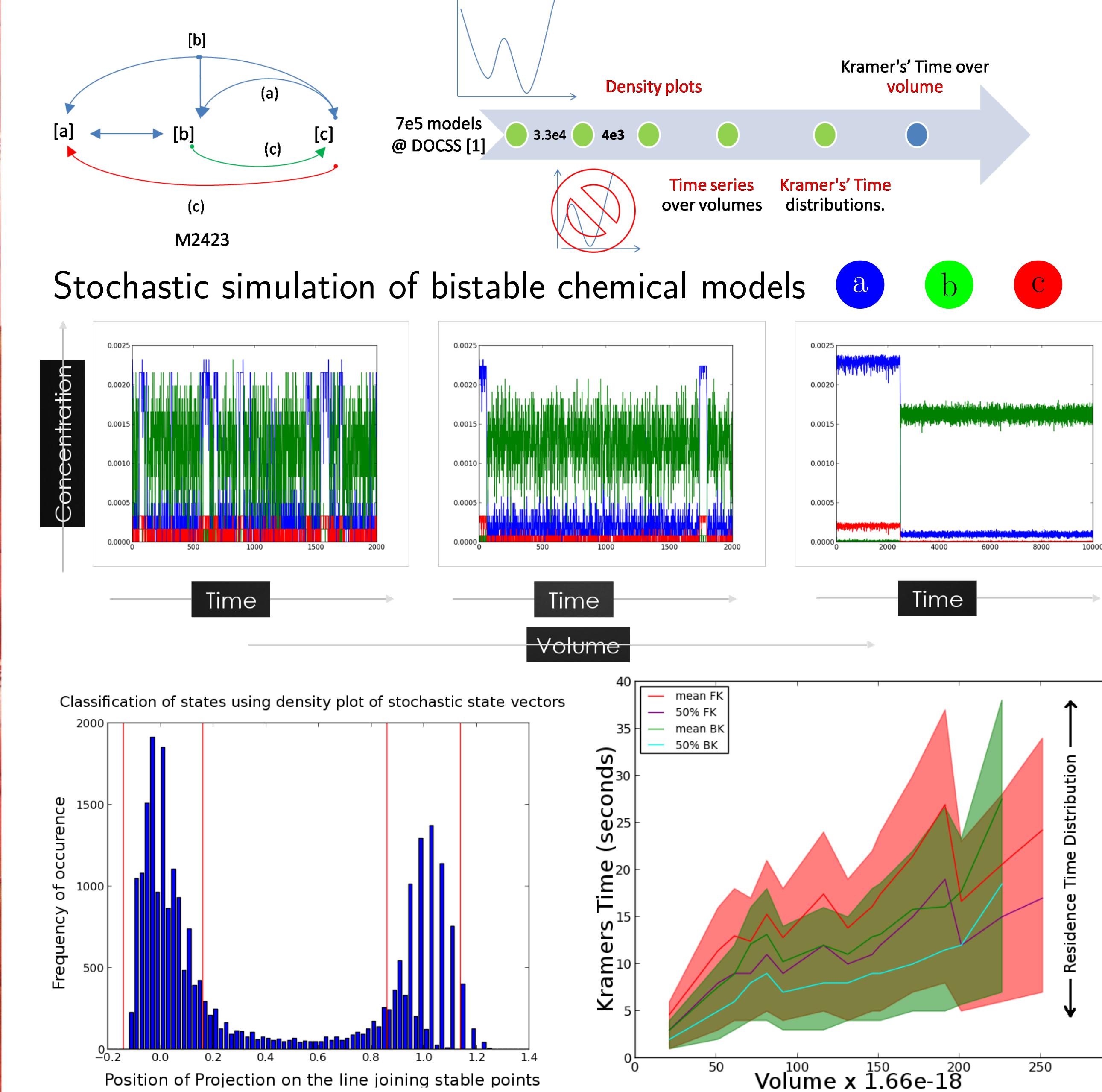
#### Predicts:

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

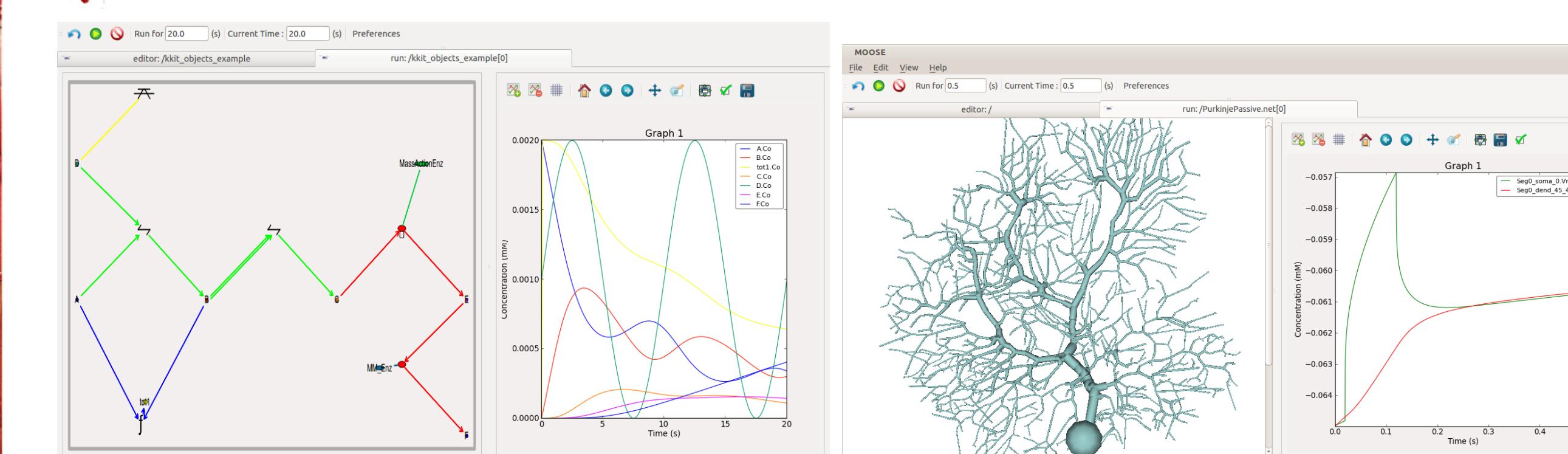


### 2.4 Robustness of Chemical Switches

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.