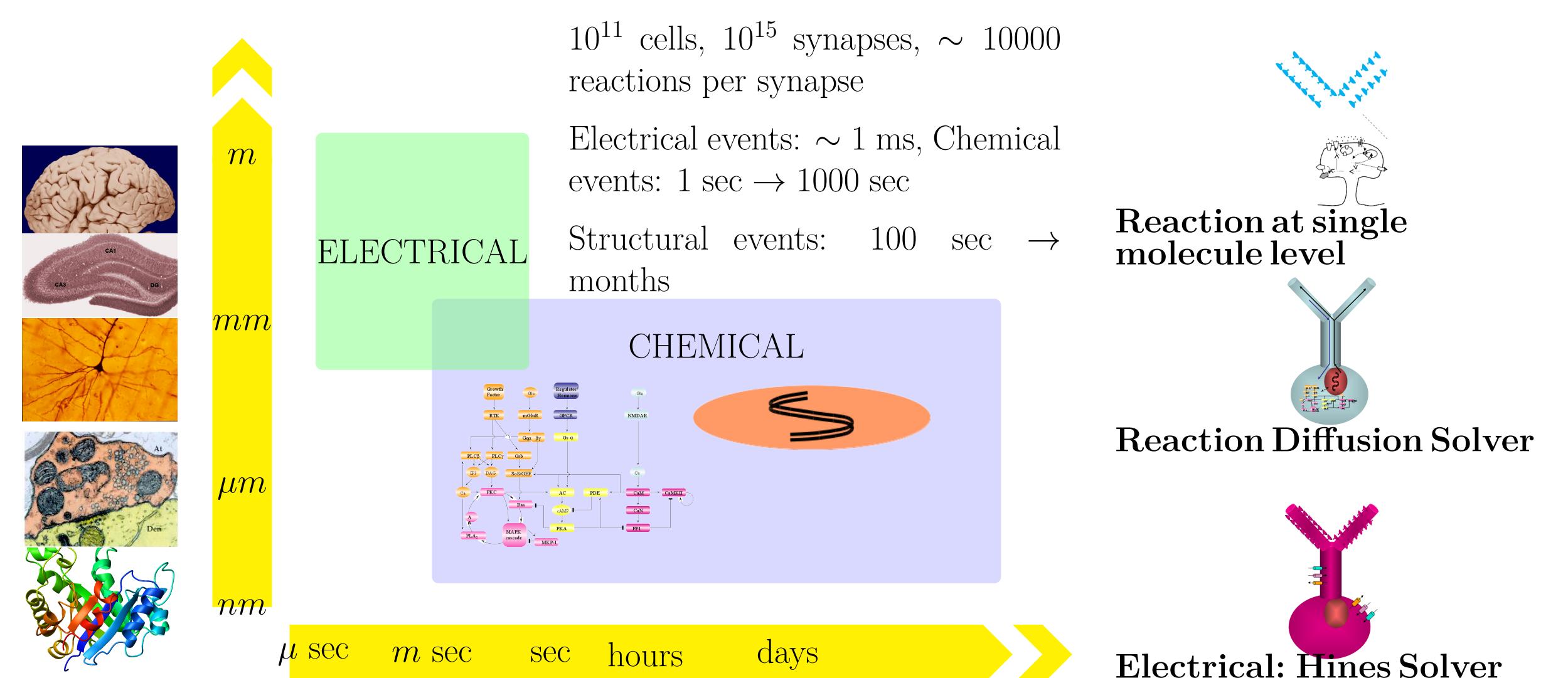


# Modelling Memory Across Scales

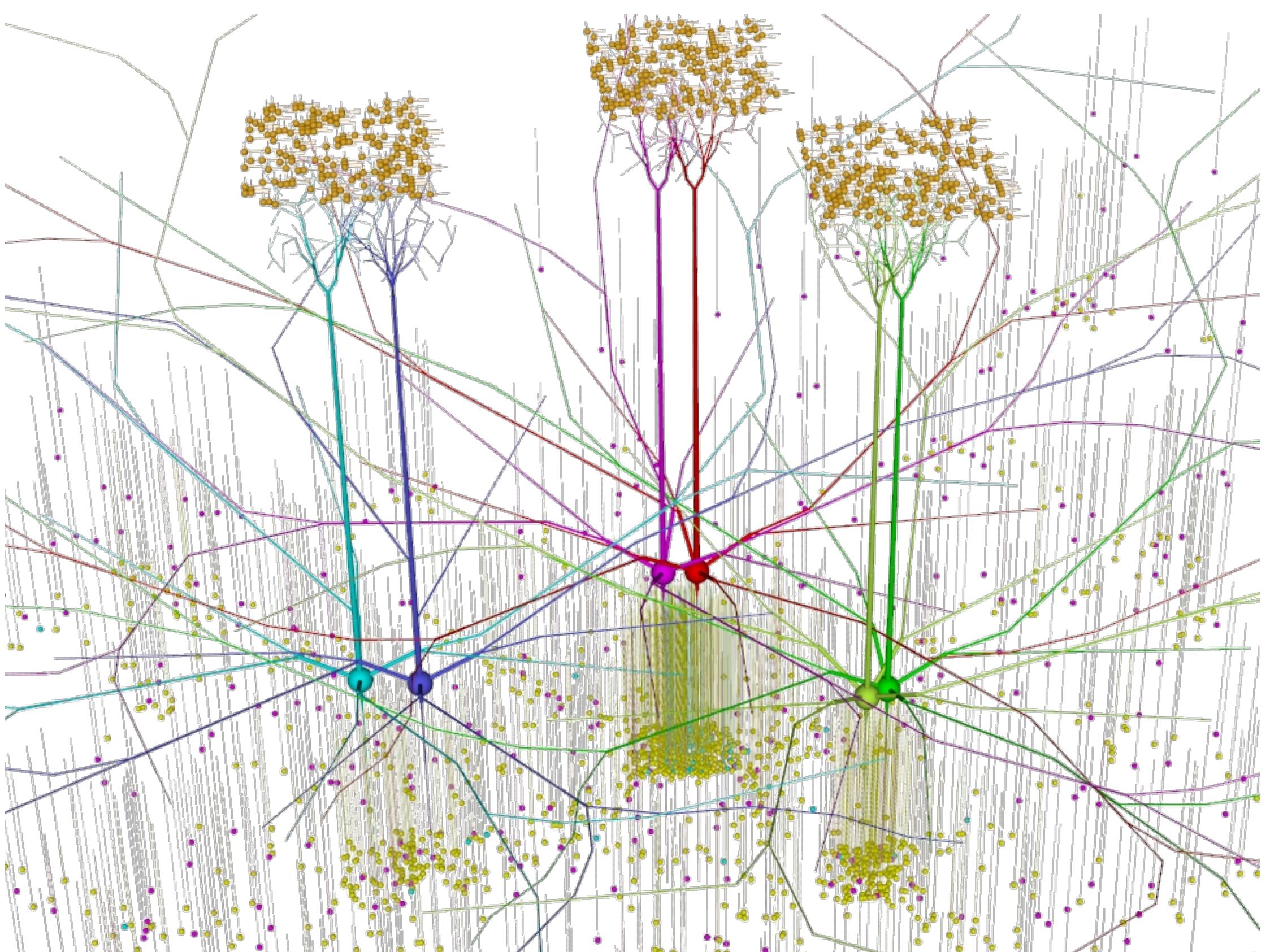
Subhasis Ray, Harsha Rani, Aditya Gilra, Sahil Moza, Aviral Goel, Dilawar Singh, Upinder Bhalla

## 1. 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 and brain computation across scales.



## 2.2 Modelling Olfactory Bulb

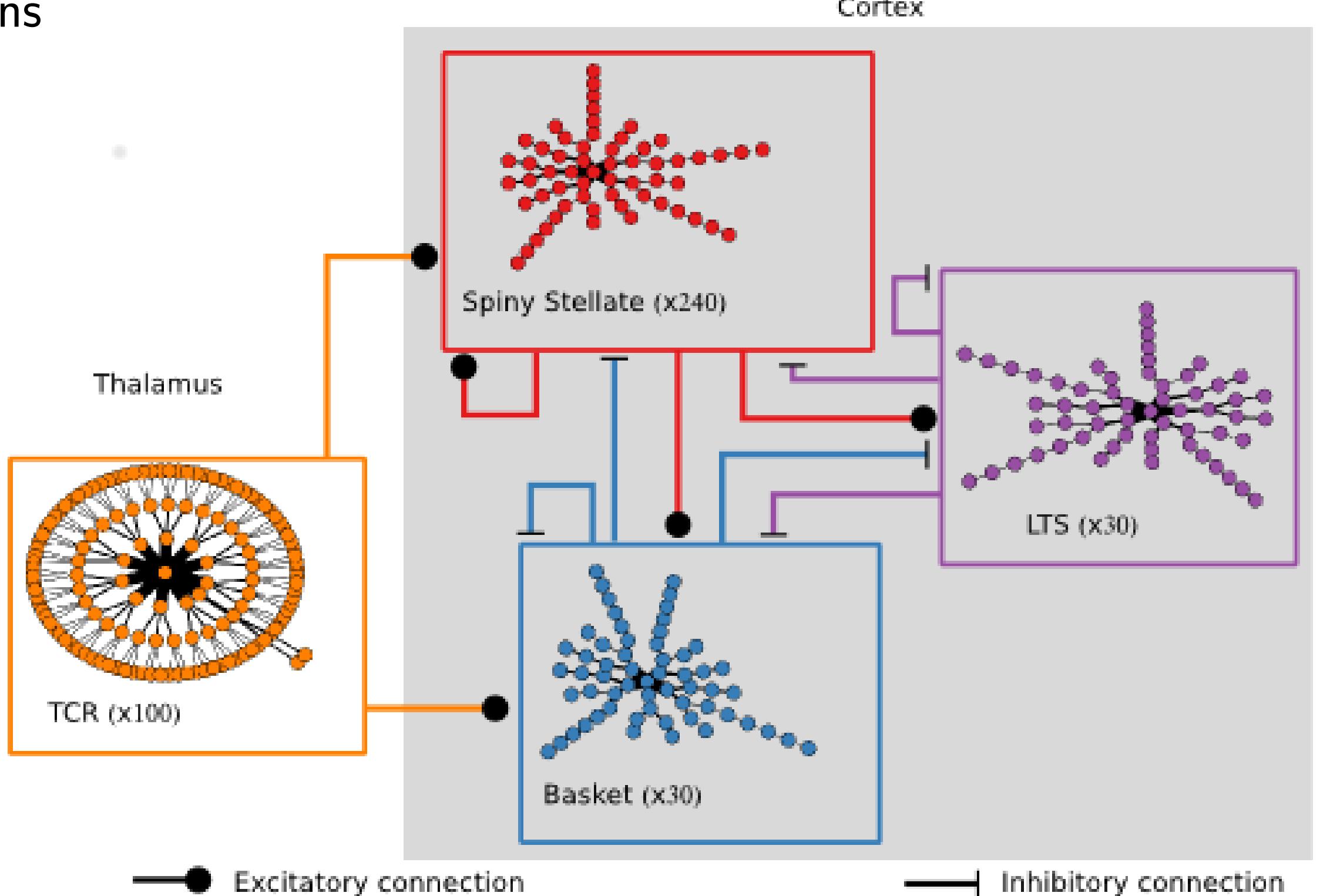


The bulb model explains linear coding and phase-decorrelation and predicts connectivity, lateral dendrite output structure.

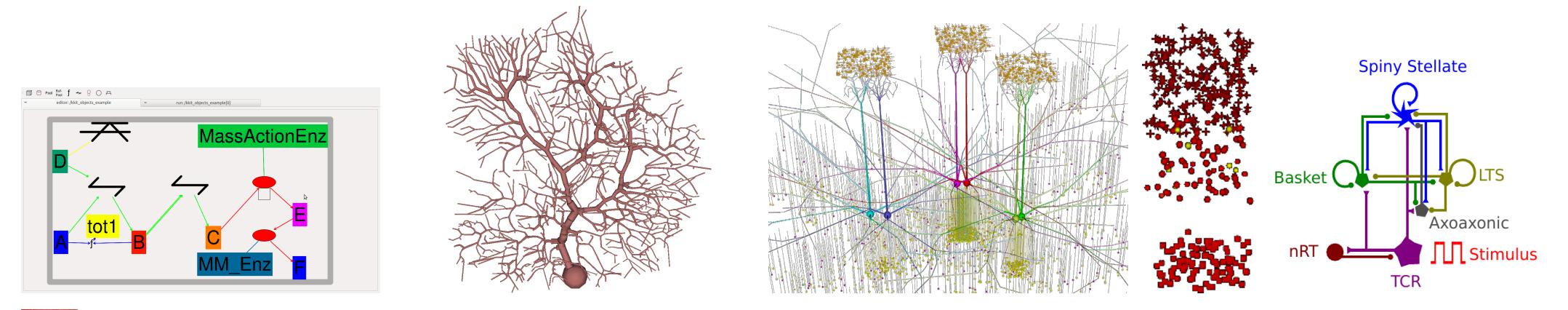
## 2.3 Modelling Cortex

**Predicts:**

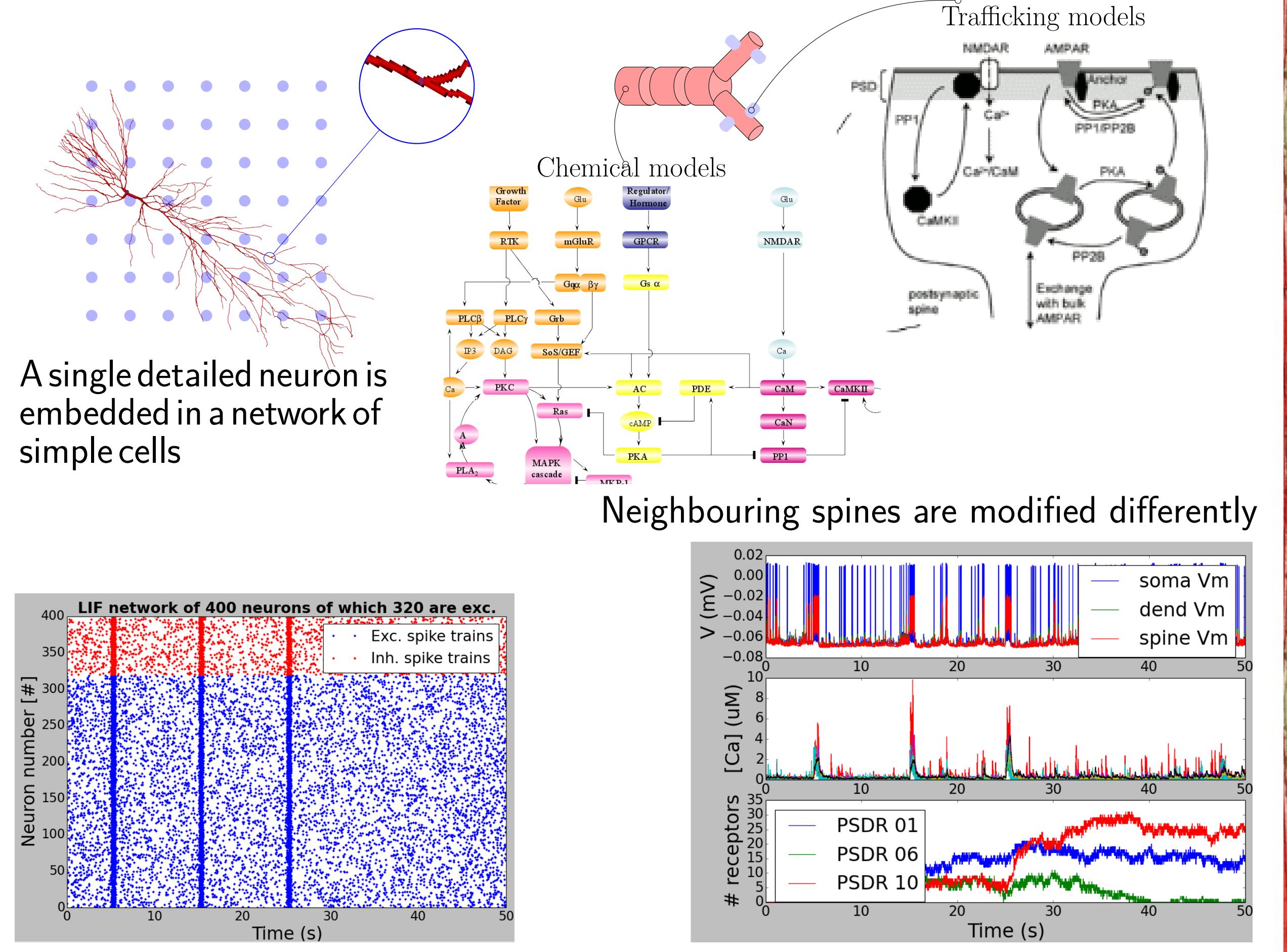
- Excitatory-Inhibitory balance needed to avoid strongly oscillatory behaviour
- Many weakly connected basket cells better at suppressing oscillations



## 2. Some projects using MOOSE

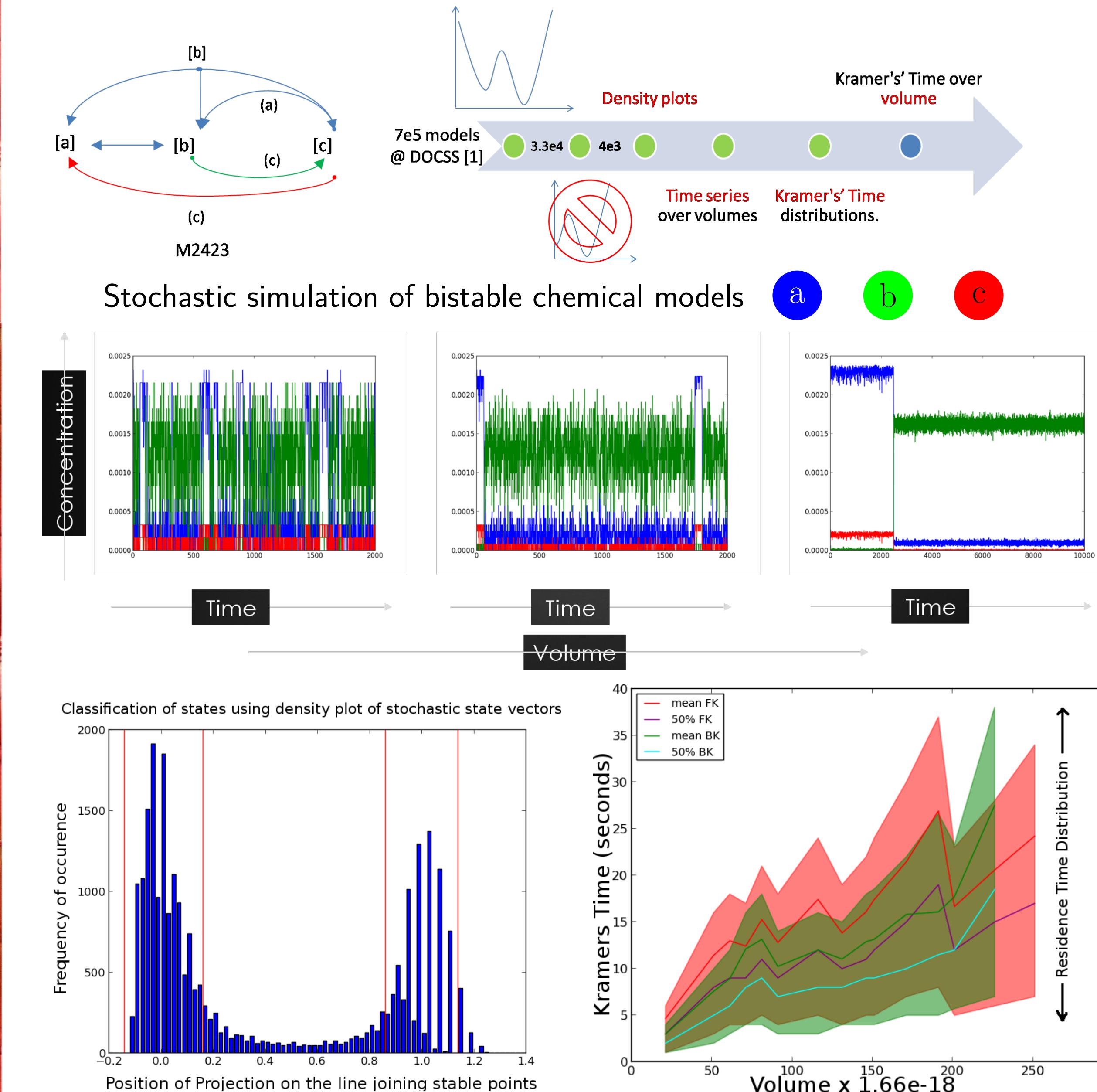


### 2.1 Modelling Memory

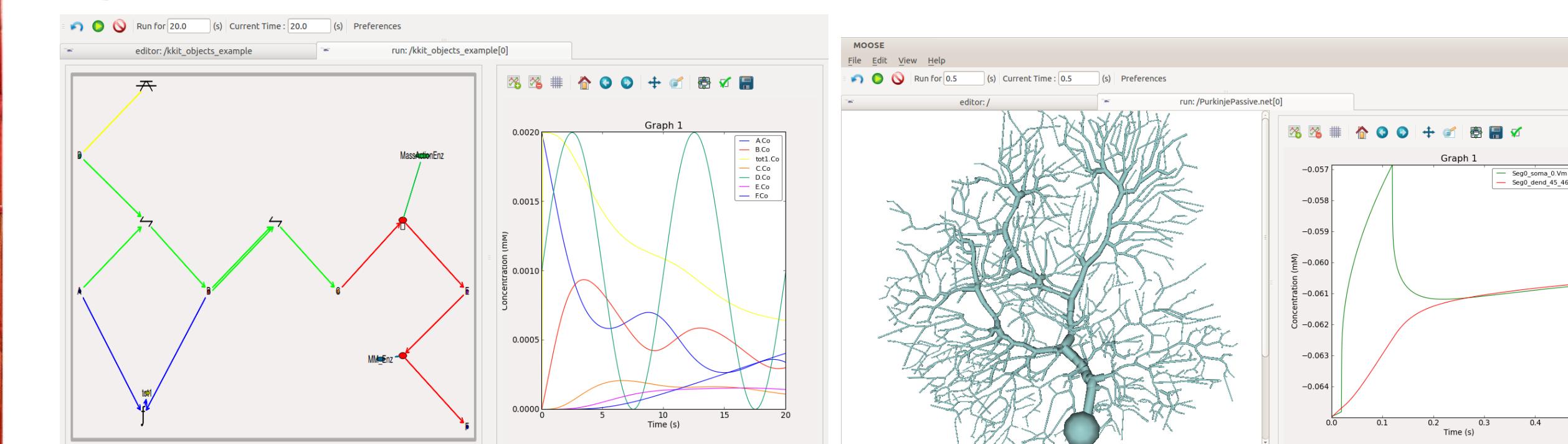


## 2.4 Robustness of Chemical Switches

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.