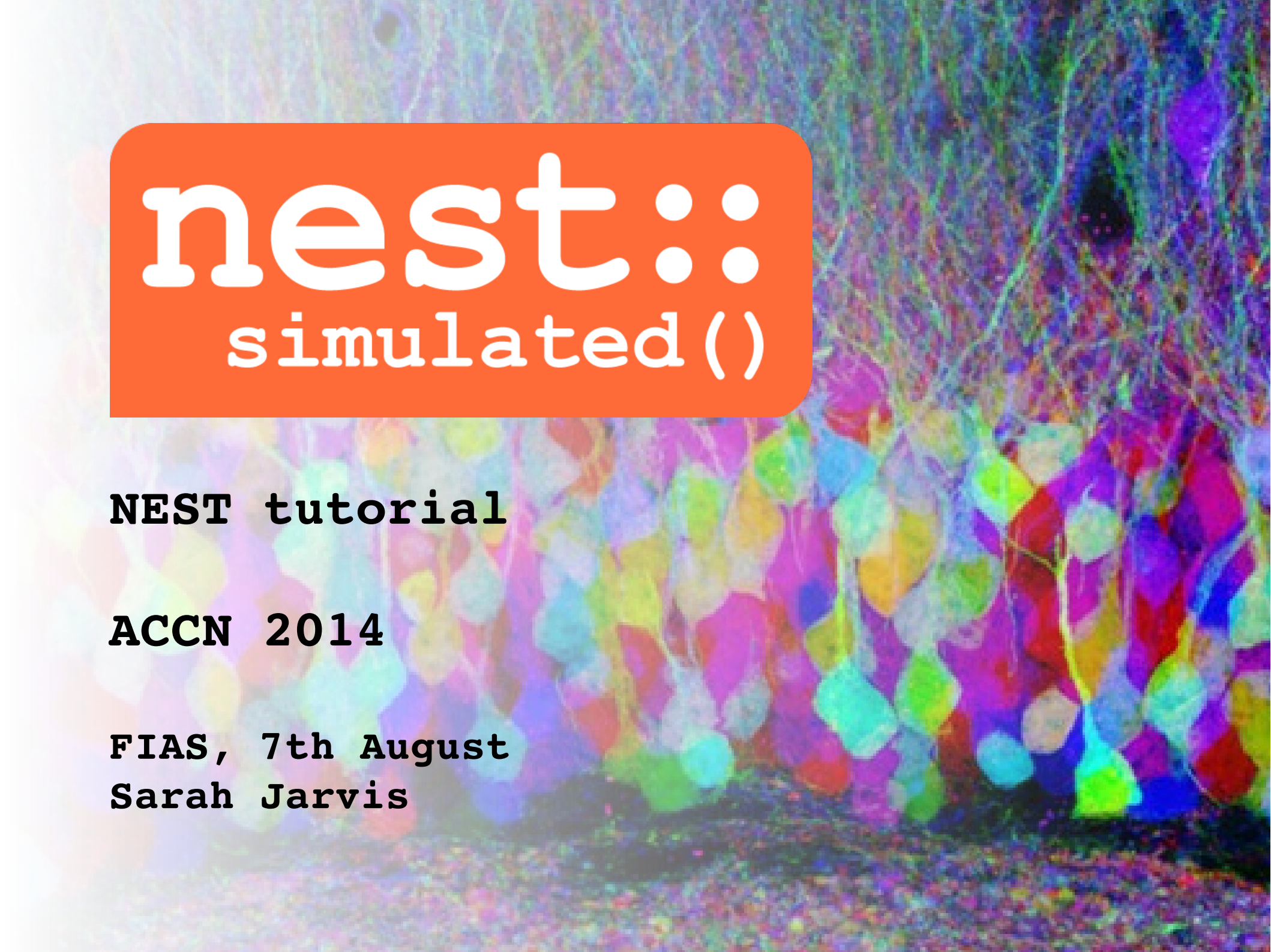
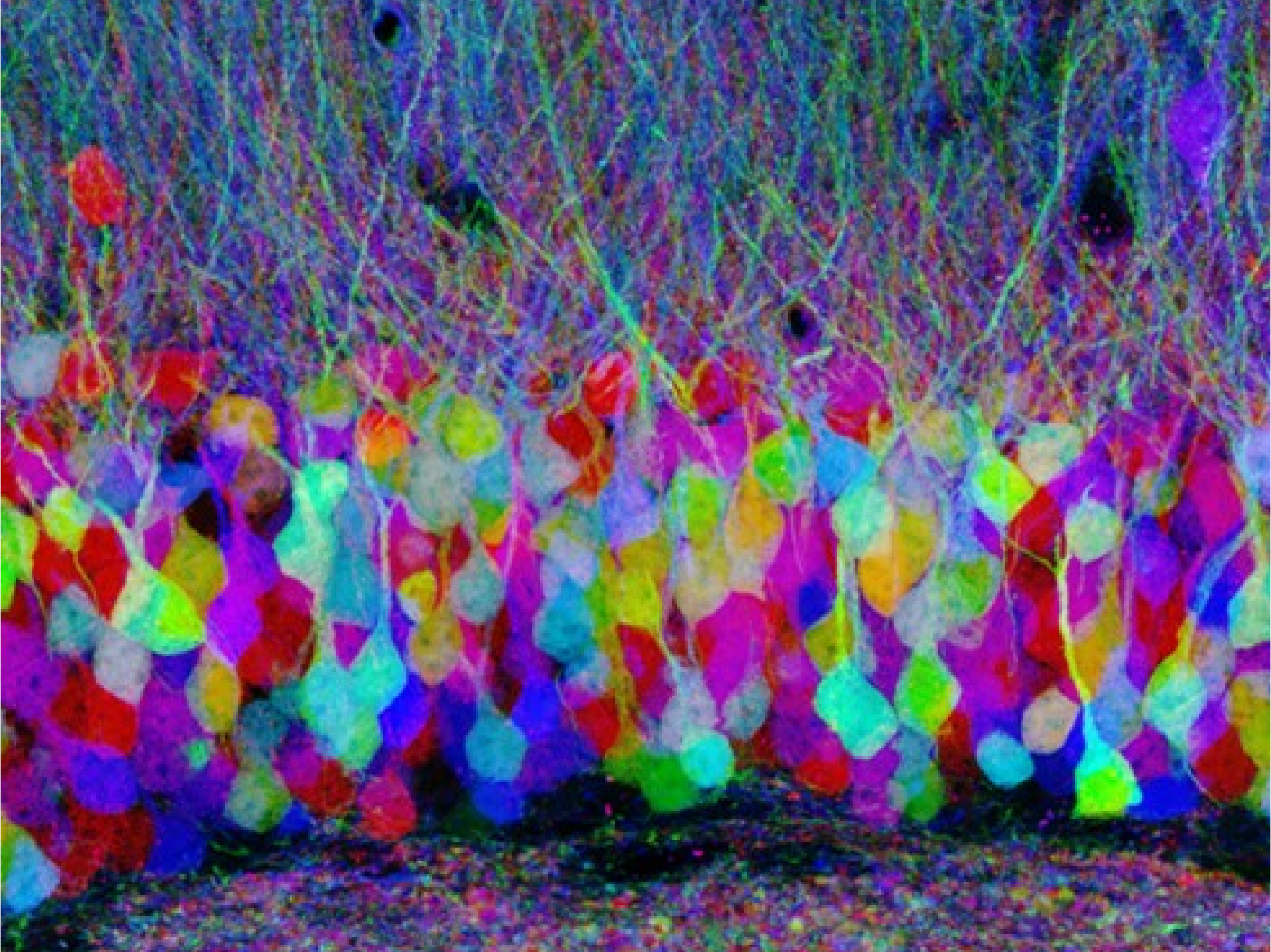


NEST tutorial

ACCN 2014

FIAS, 7th August

Sarah Jarvis




Infrastructure is expensive!
Communication is even more expensive!

What is NEST?

- **NE**ural **S**imulation **T**ool

- Emphasis: spiking neuron models in (large) network

NEST is a simulator for spiking neural network models that focuses on the dynamics, size and structure of neural systems rather than on the exact morphology of individual neurons.

NEST is ideal for networks of spiking neurons of any size, for example:

- Models of information processing e.g. in the visual or auditory cortex of mammals,
- Models of network activity dynamics, e.g. laminar cortical networks or balanced random networks,
- Models of learning and plasticity.

- www.nest-initiative.org

What model features are supported?

Neuron models:

- IF neurons and variants
  - Current-based
  - Conductance-based
- AdEx
- MAT2
- Hodgkin-Huxley
- Izhikevich
- McColloch-Pitts
- Ginzberg
- multicompartmental

Synapse models:

- Static synapse
- Tsodyks
- STDP
- STDP – dopamine
- HT Synapse

Connectivity models:

- Specific (user-defined)
- Random
- Topological:
  - 2D and 3D
  - Spatial kernels
  - Weights and delays also proportional

Also possible to define own models for each!

Backend features of NEST

… are not something that I'm going to talk about in 90mins

Except to say that NEST is

- Fast
- Scalable
- Able to be parallelized
- Supported by all major platforms
- Supported by an active community of developers/users
- Plays well with other simulation tools
- Easy to code (Python)
- Customisable

Sources and support

- www.nest-initiative.org
- NEST mailing list
- Tutorial material and manuals (Topology)
- Inline:

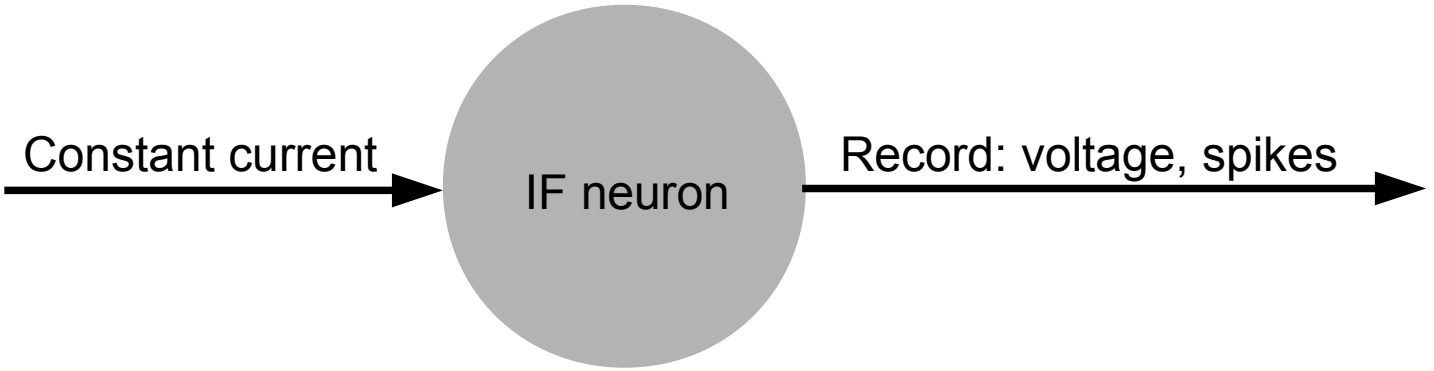
```
nest.help()
nest.helpdesk()
nest.help('iaf_psc_delta')
nest.help('Connect')
nest.Connect?
```

What we're going to do today:

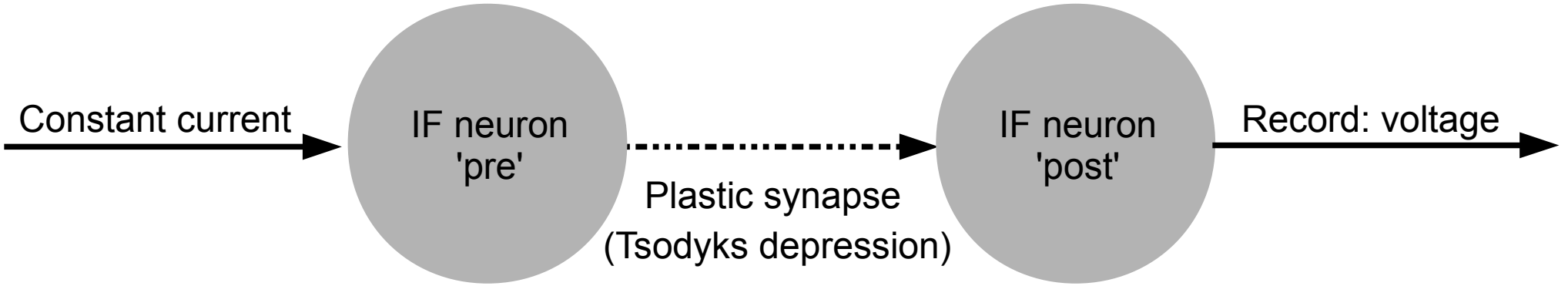
- Four examples
  1) Simple neuron
  2) Pair of neurons with plasticity
  3) Two populations with random connectivity
  4) Population with topological connectivity

All examples will be available after the tutorial!

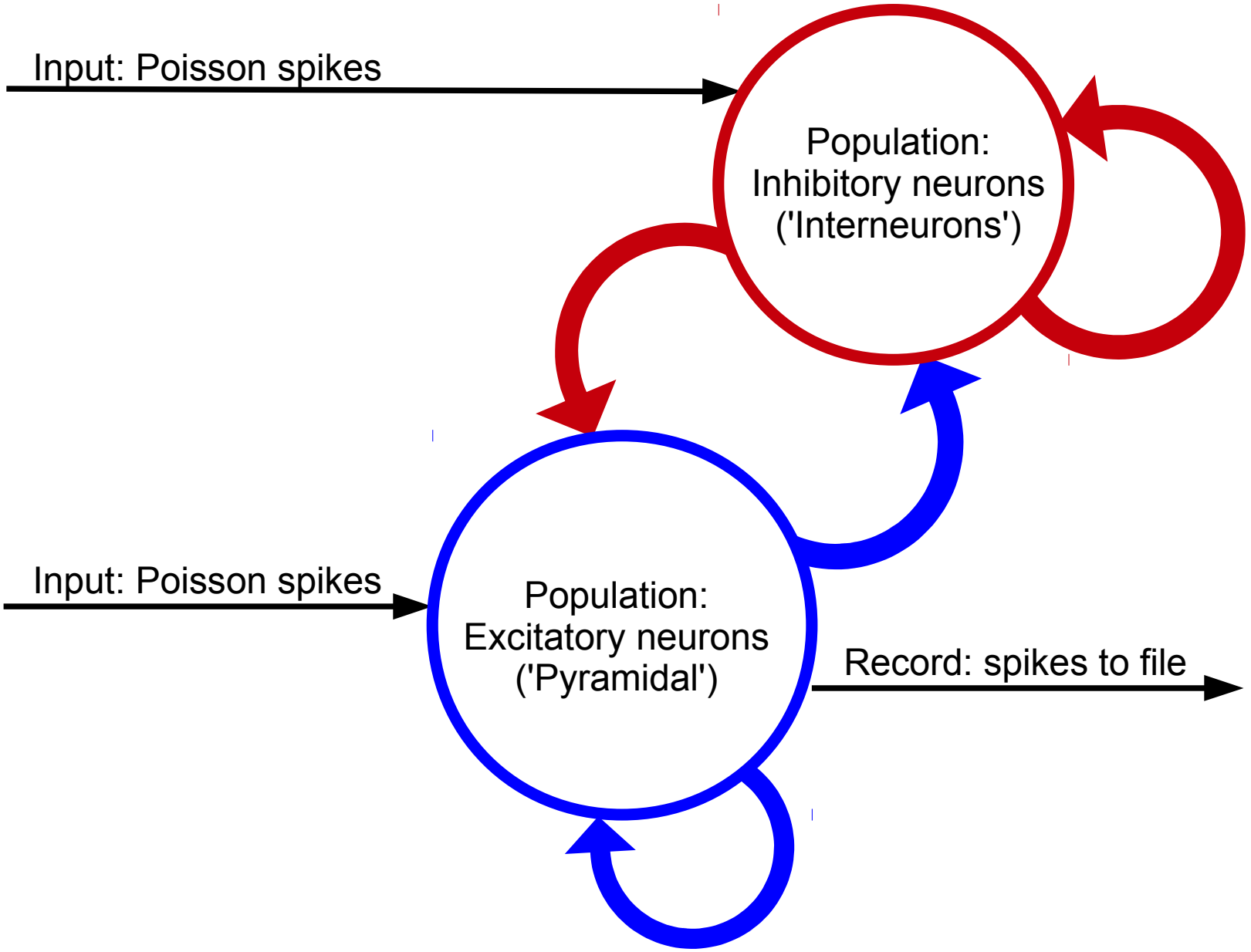
Example 1: single neuron



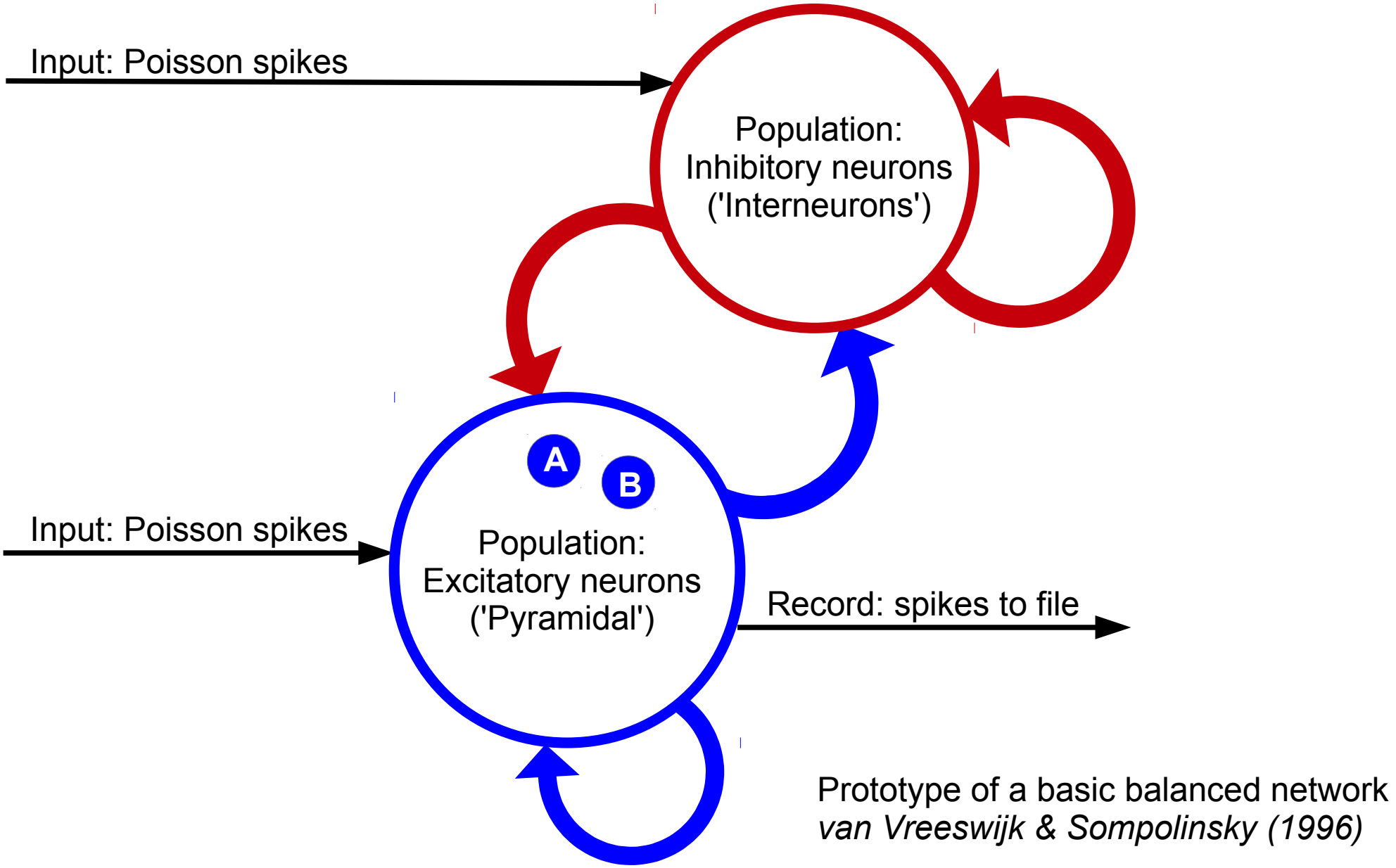
Example 2: paired neurons with plasticity



Example 3: populations of neurons

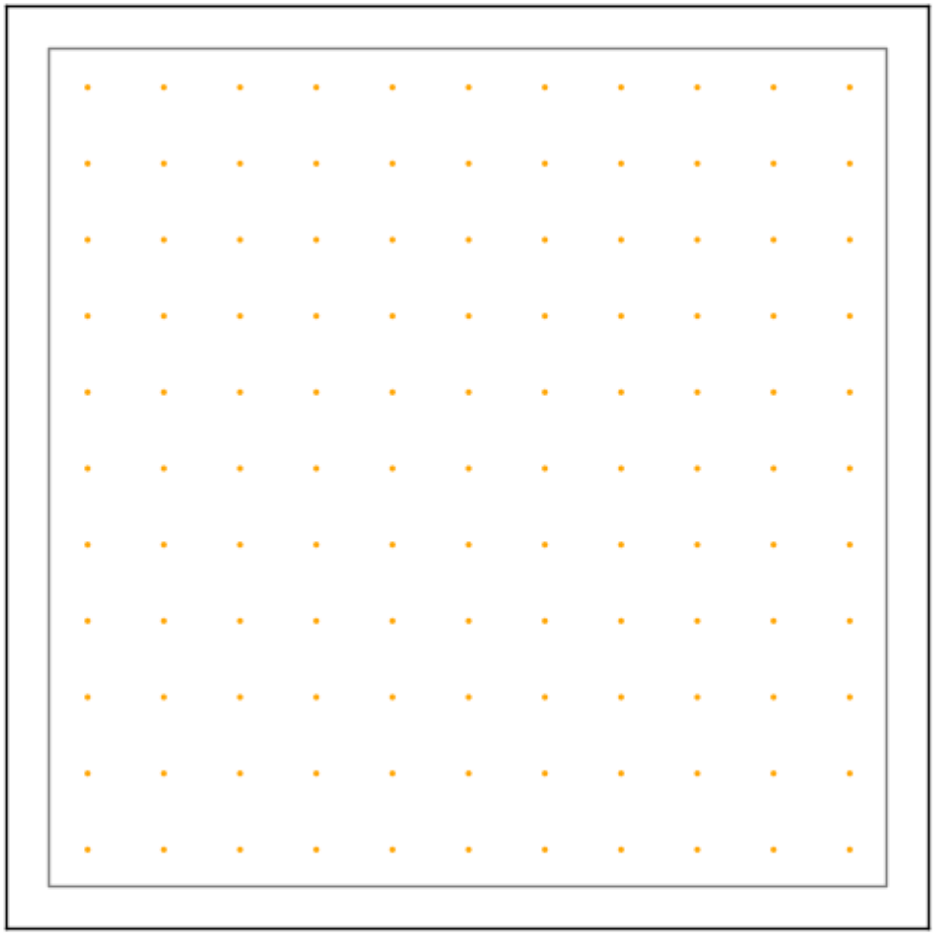


Example 3: populations of neurons

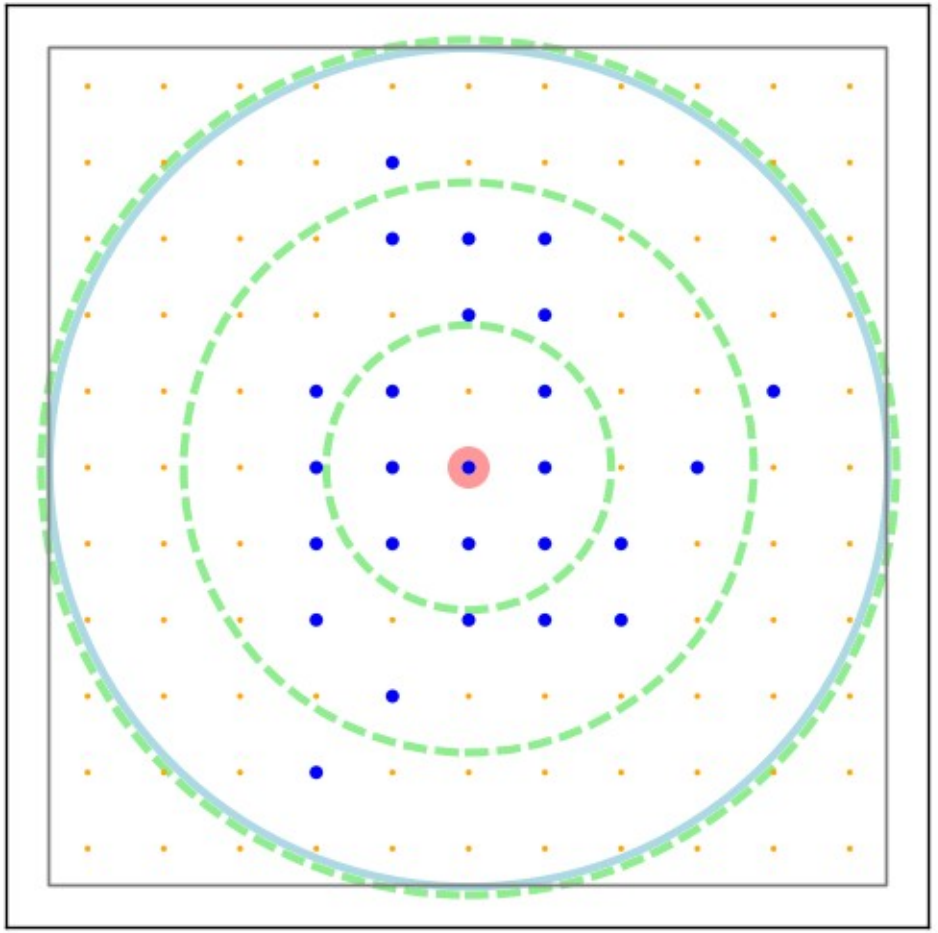


Prototype of a basic balanced network
van Vreeswijk & Sompolinsky (1996)

Example 4: Topology!



Example 4: Topology!



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