



Synchrony

Jonas et al. 2006
Buzsaki et al. 1996

8th April 2011
Julie Dethier and Patrick Ye

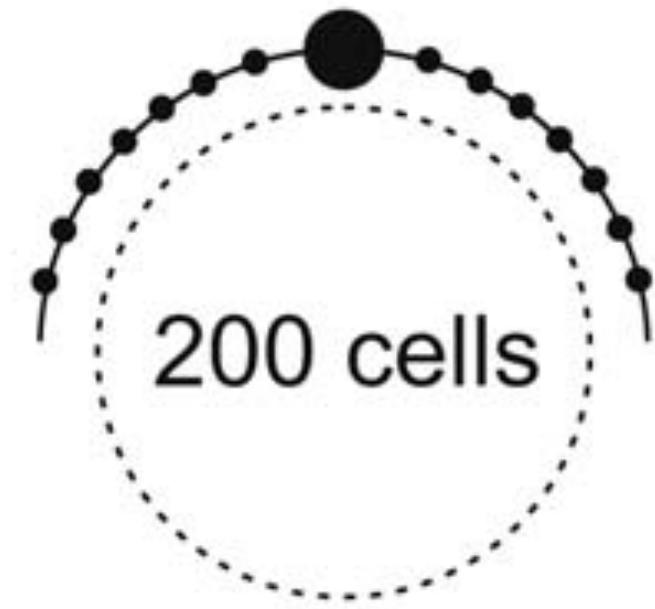
Synchrony

- ▶ *Unexpectedly, when shunting inhibition is incorporated into a structured interneuron network model with fast and strong synapses, coherent oscillations emerge*
- ▶ Advantages over hyperpolarizing inhibition:
 - ▶ oscillations are generated with **smaller** tonic excitatory drive;
 - ▶ network frequencies are tuned to the γ band;
 - ▶ **robustness** against heterogeneity in the excitatory drive is markedly improved.



Model

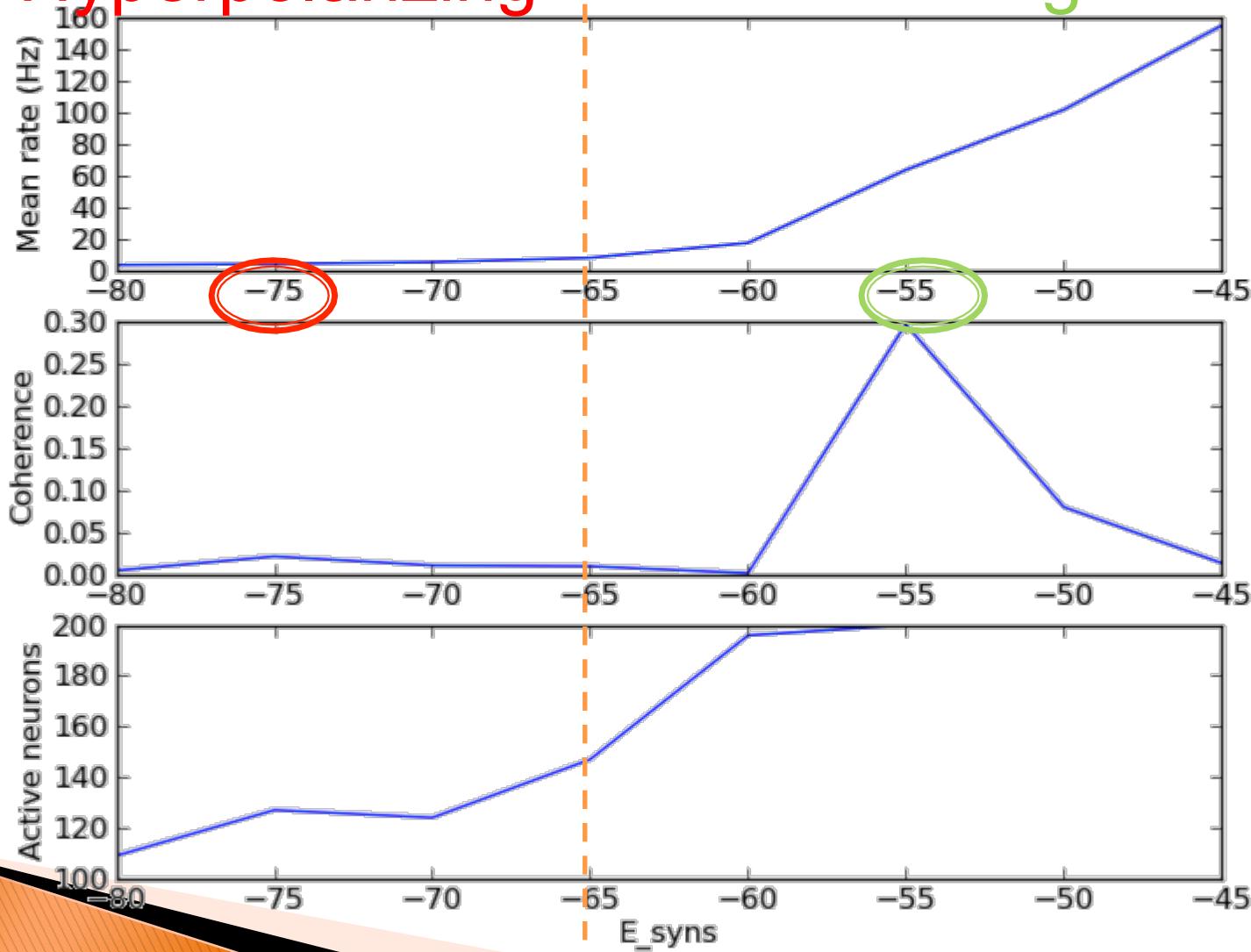
- ▶ Ring of 200 neurons
- ▶ Connected to 50 out of 100 closest neighbors
- ▶ Hodgkin–Huxley
- ▶ Tonic current
- ▶ Inhibitory synapses
 - ▶ Fixed strength and delay



Inhibition

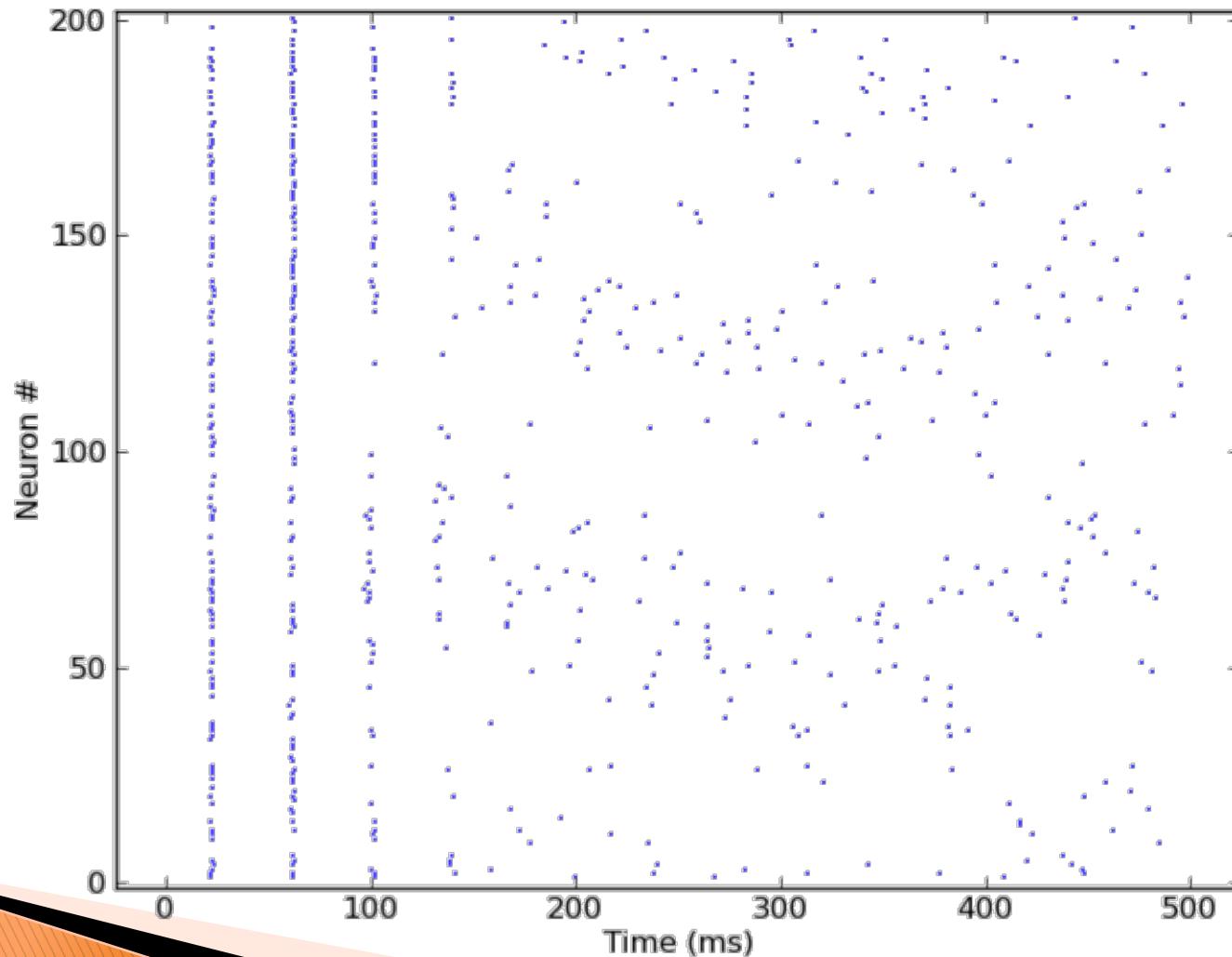
Hyperpolarizing

Shunting



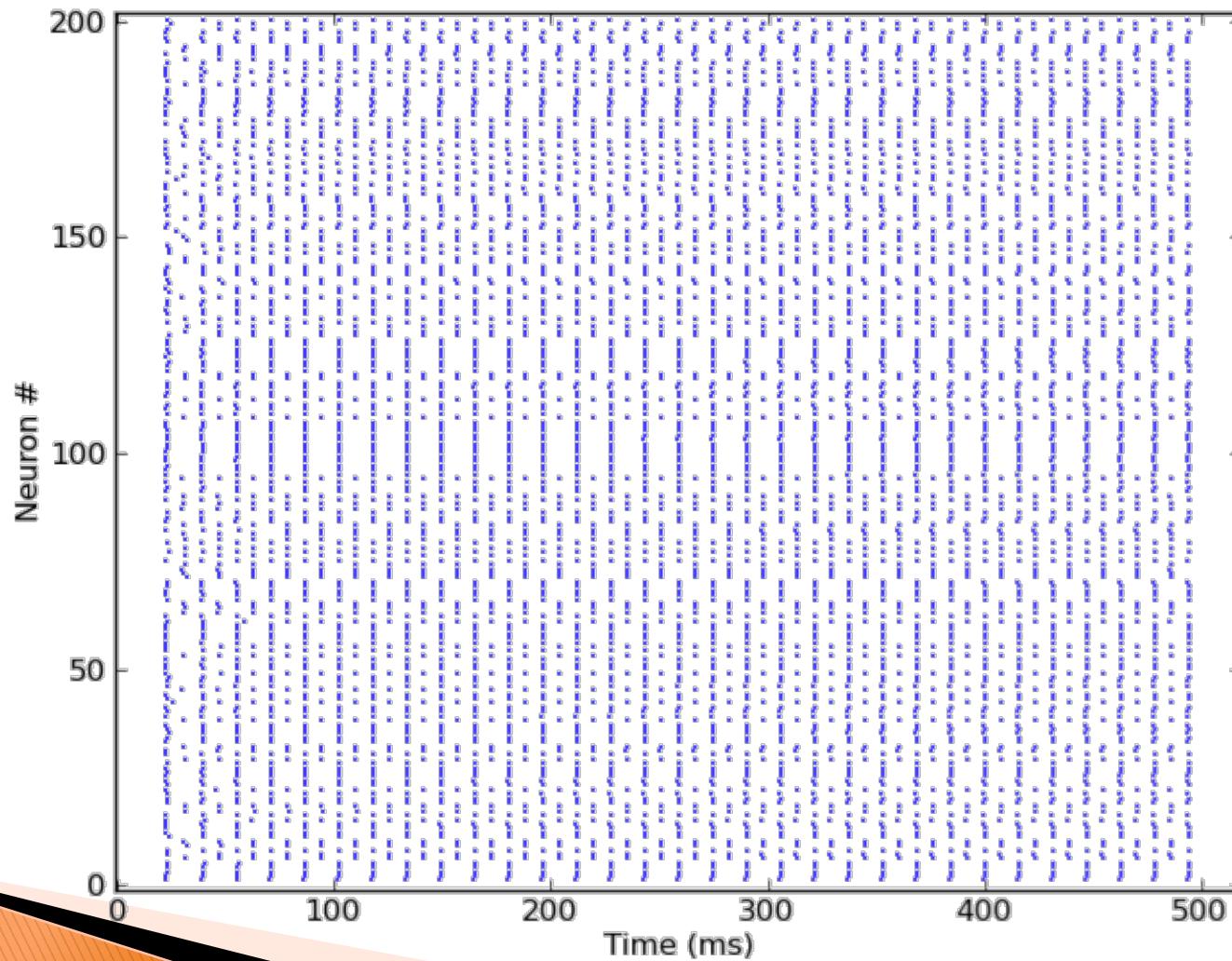
Spike raster

Hyperpolarized: $E_{syn} = -75\text{mV}$



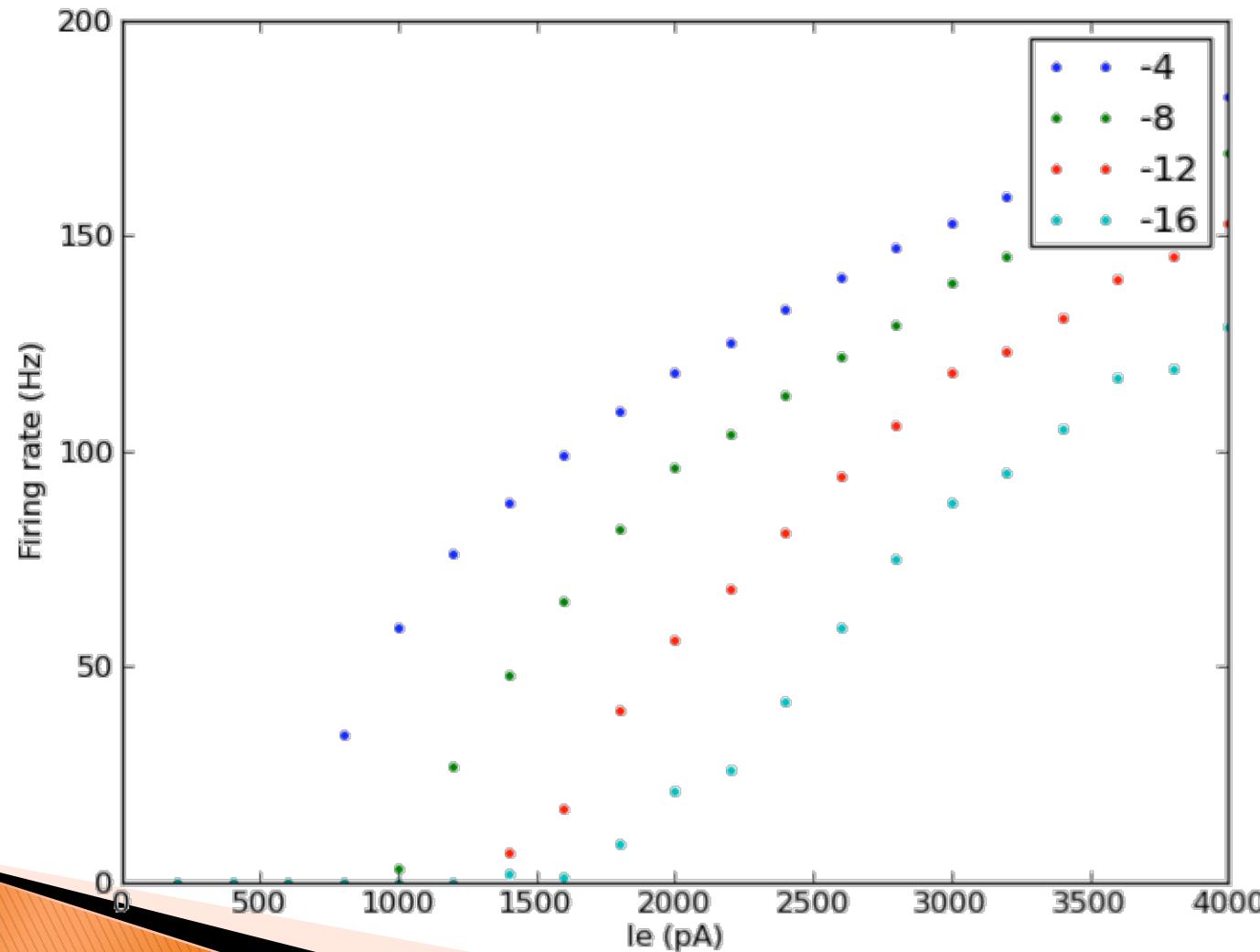
Spike raster

Shunting: $E_{syn} = -55\text{mV}$



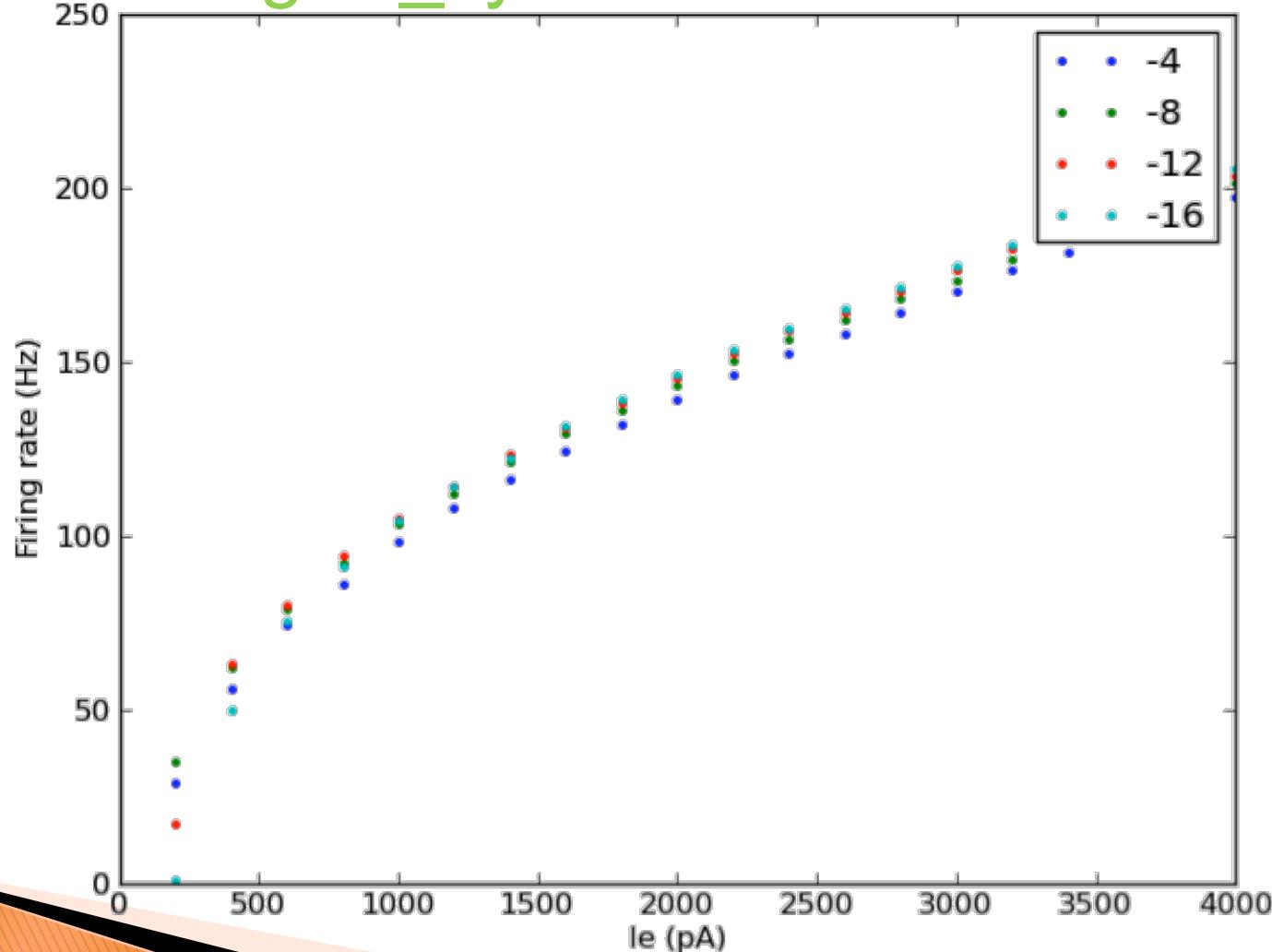
IF curve:

Hyperpolarized: $E_{syn} = -75\text{mV}$



IF curve:

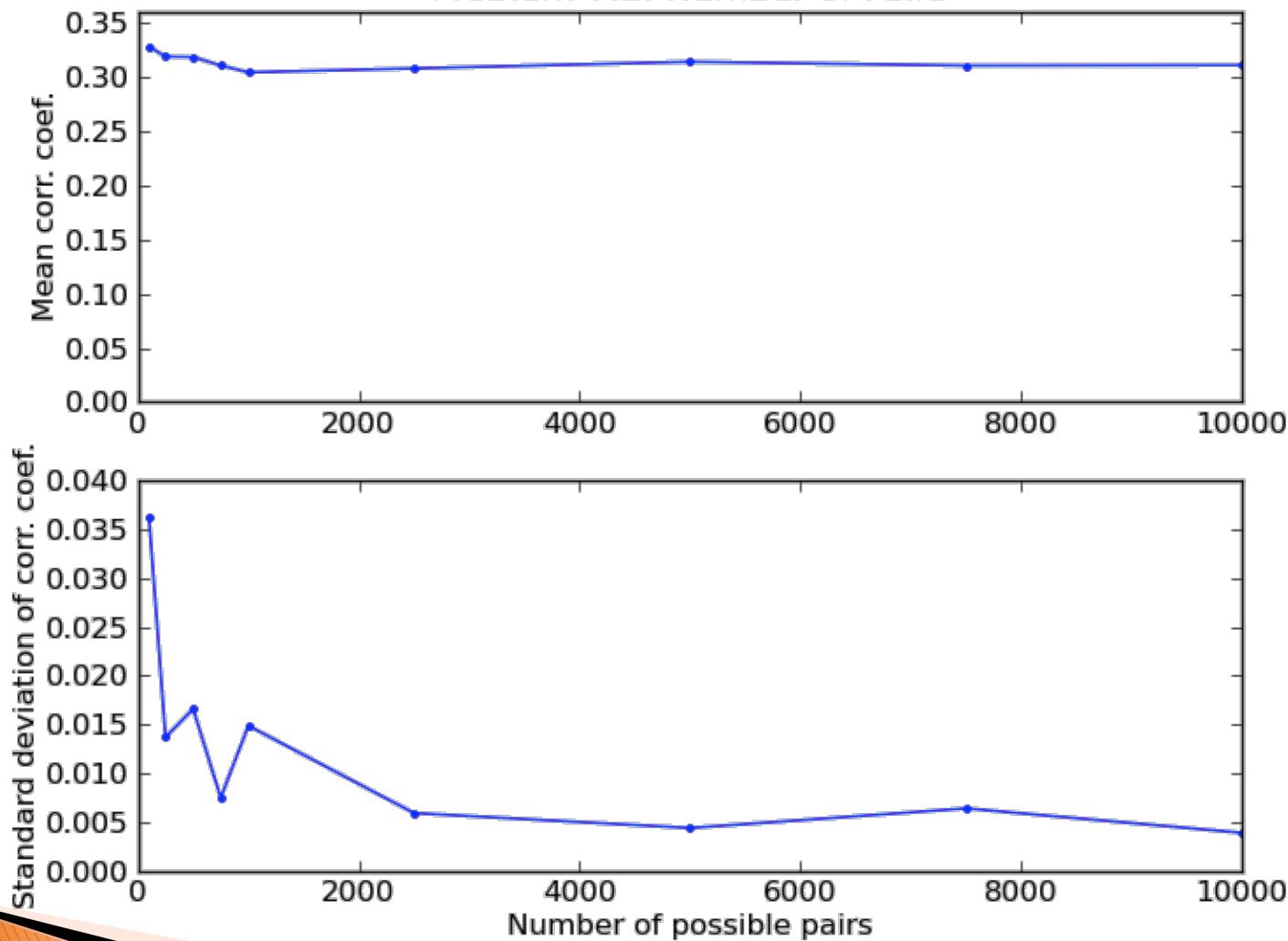
Shunting: $E_{syn} = -55\text{mV}$



$E_{syn} =$
-55mV

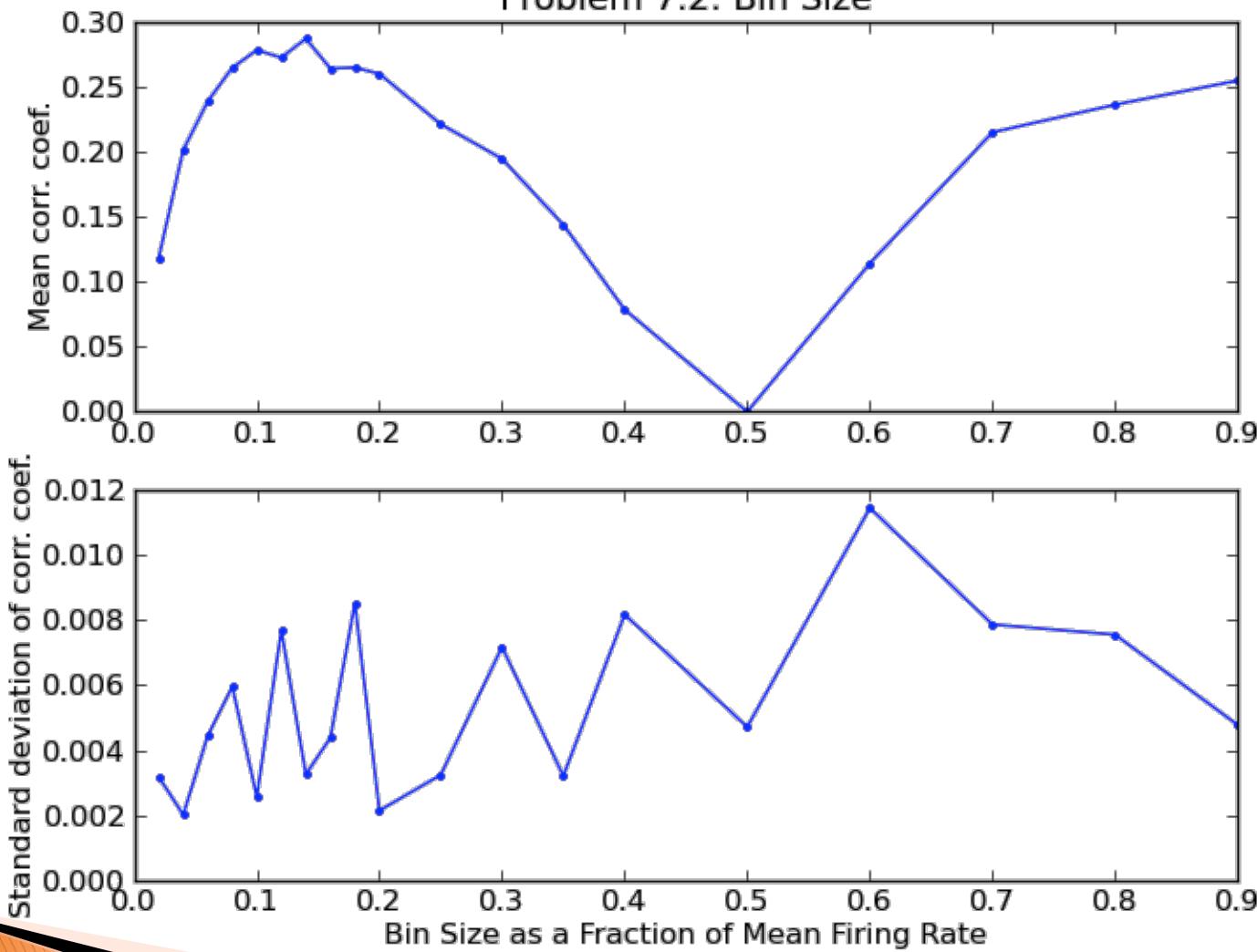
Number of random pairs:

Problem 7.2: Number of Pairs



Bin size of Pearson corr. coef.

Problem 7.2: Bin Size

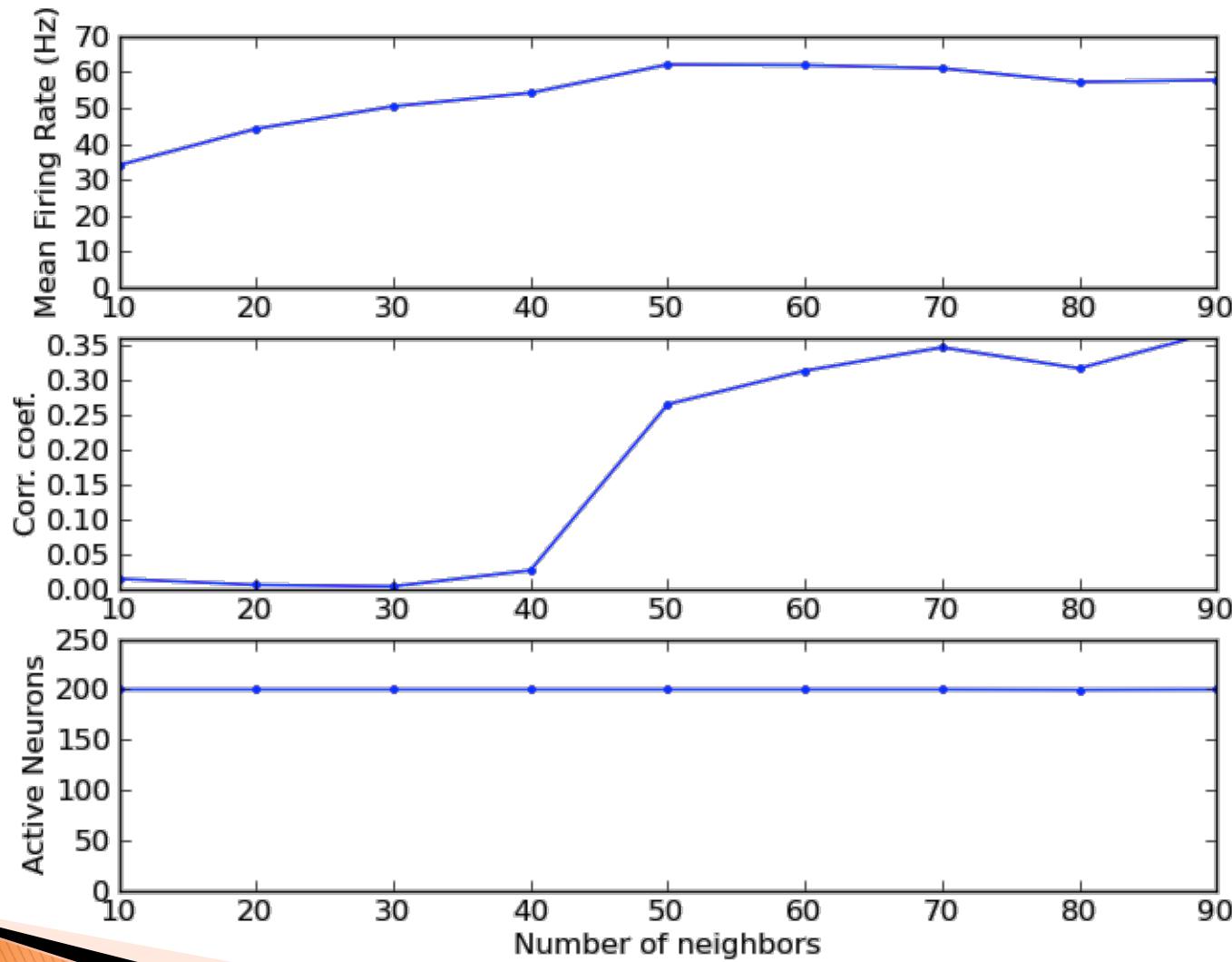


$E_{syn} = -55\text{mV}$

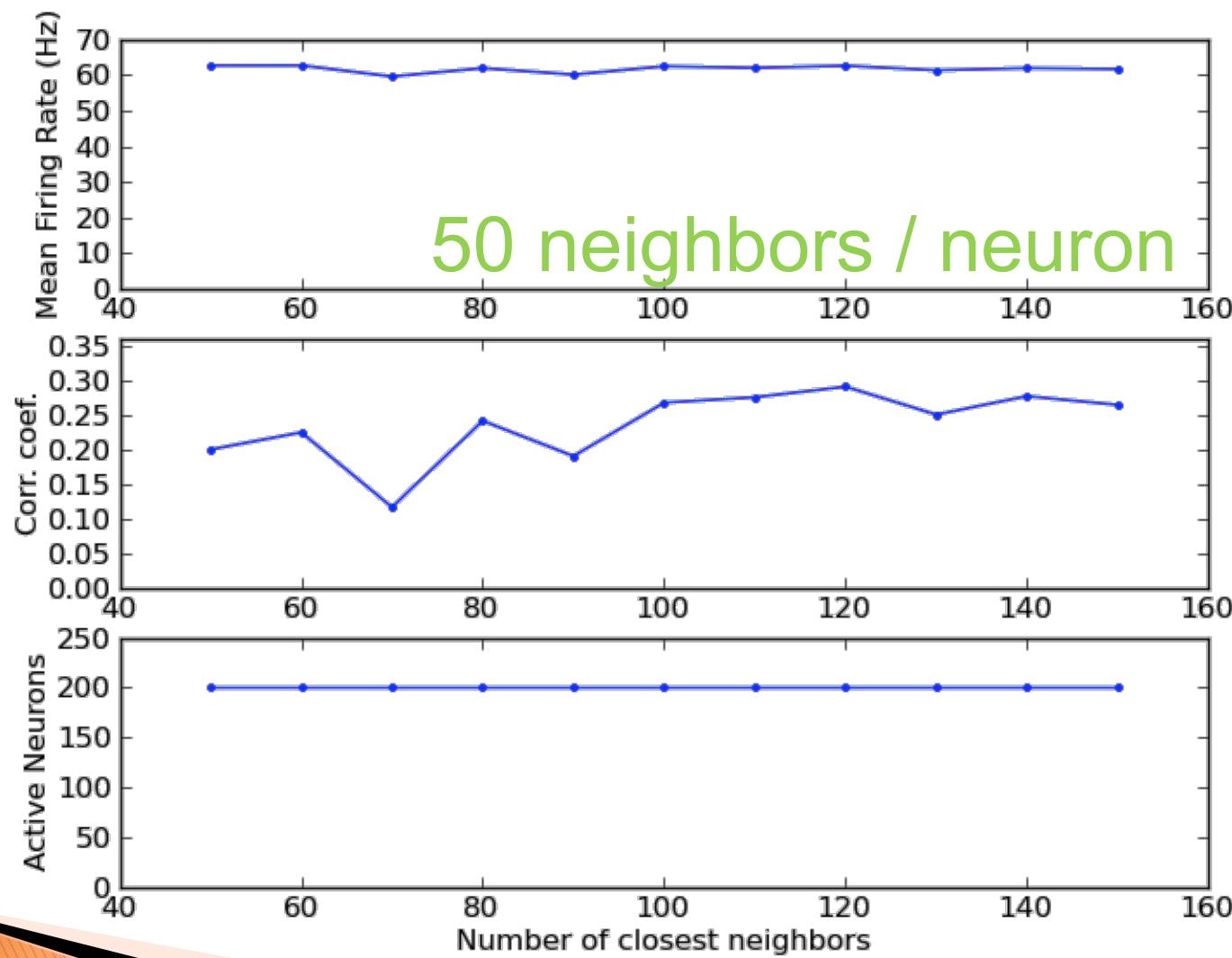


Number of Neighbors:

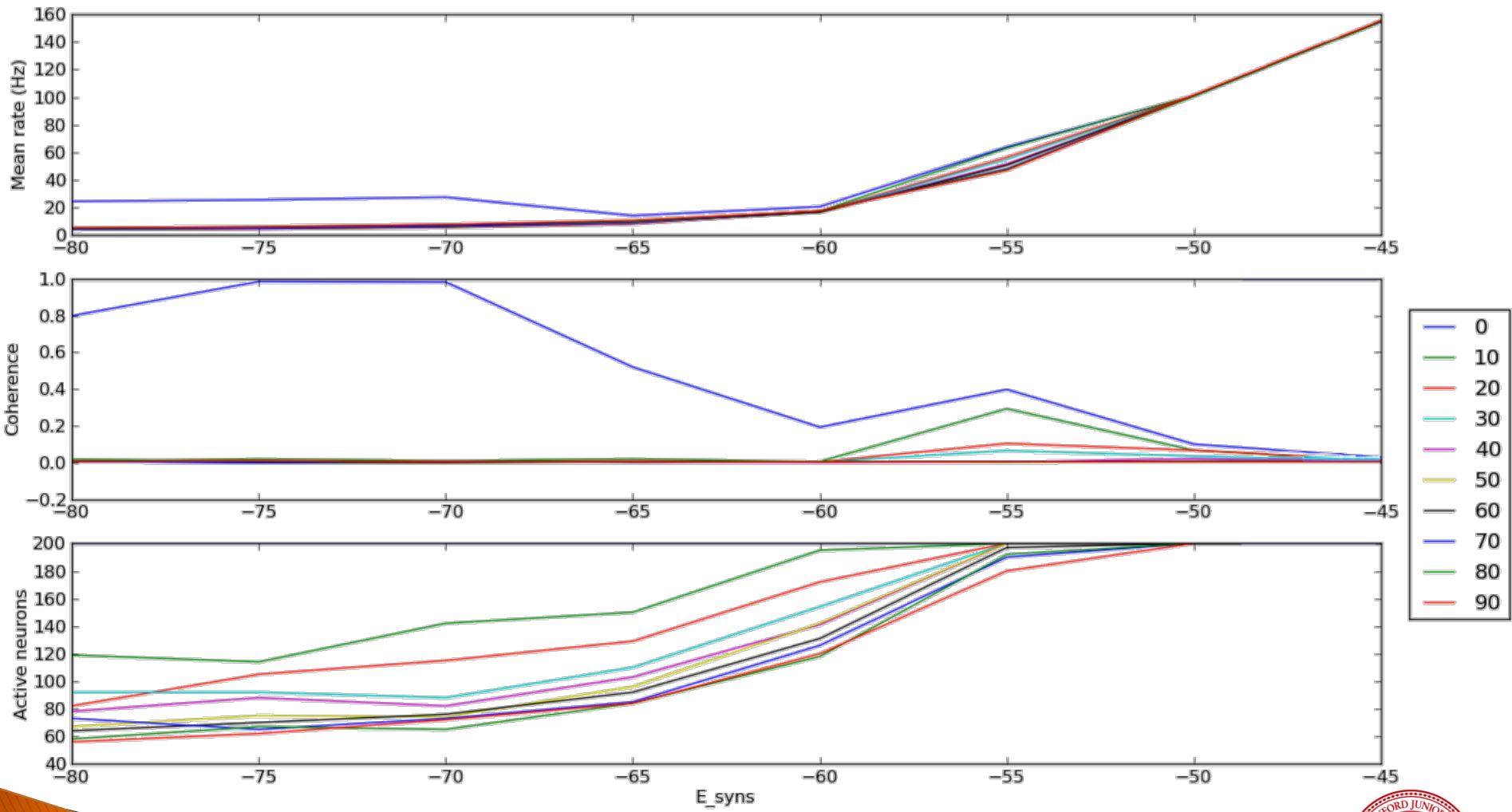
out of 100
neighbors



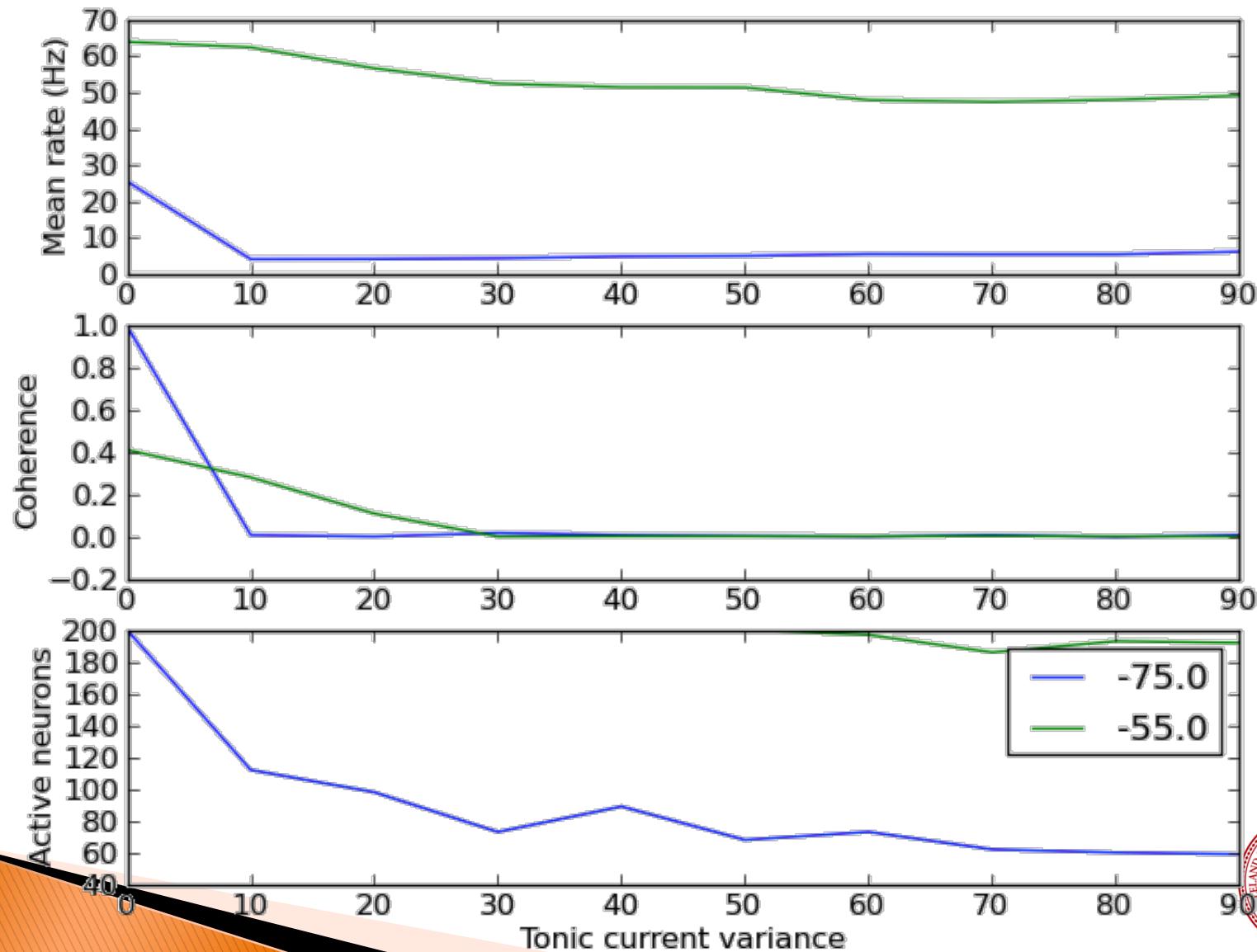
Number of Closest Neighbors:



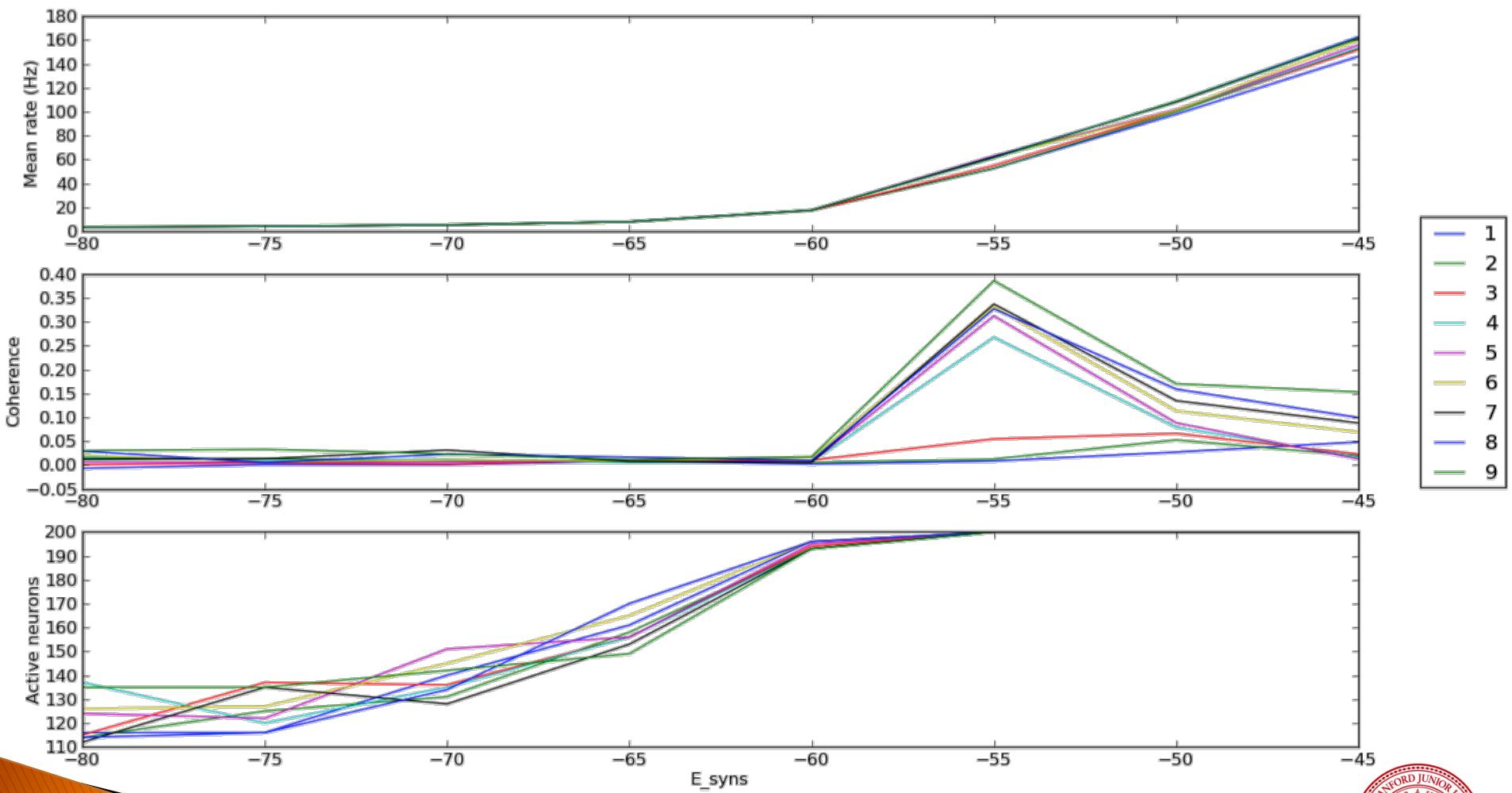
Tonic current drive variance:



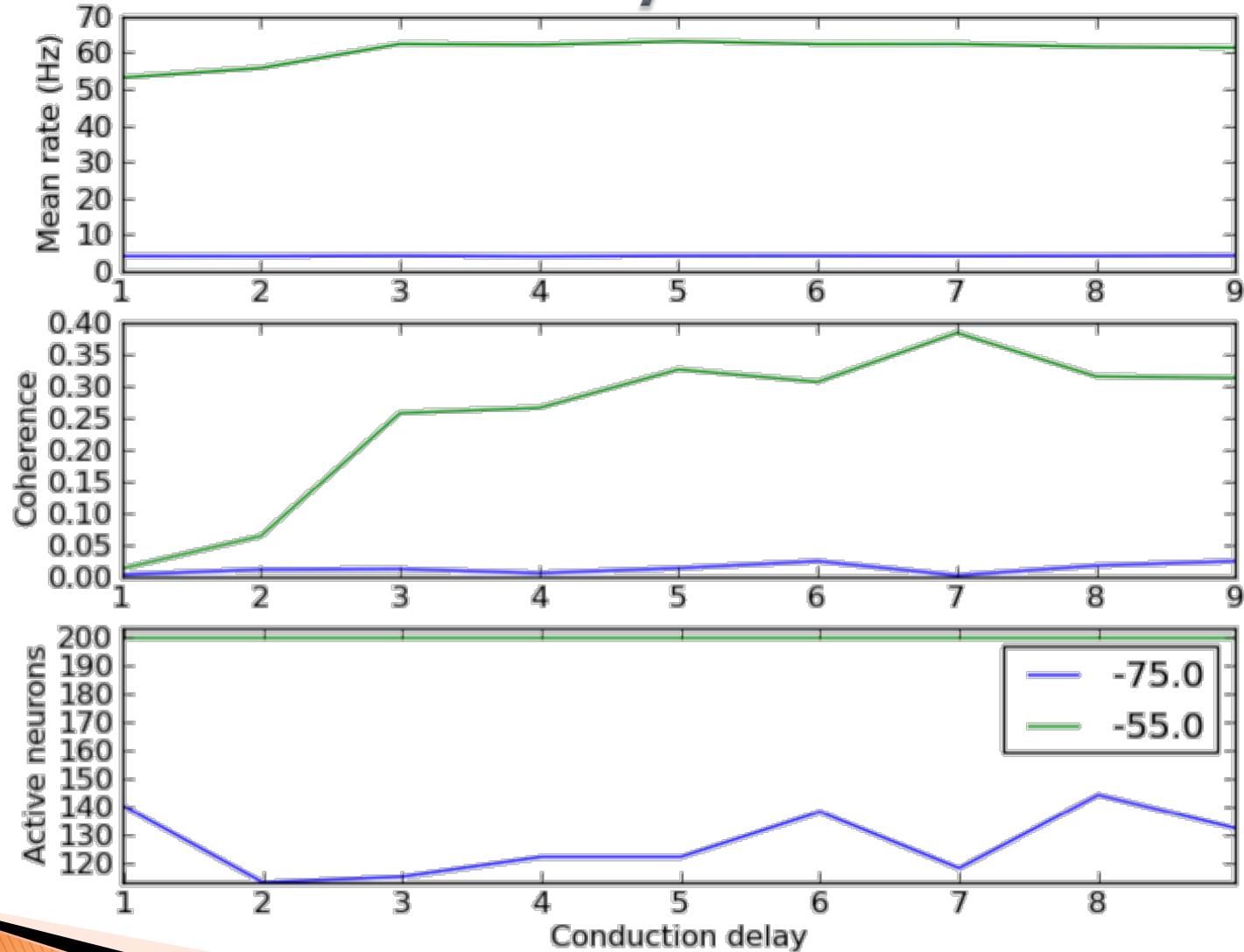
Tonic current drive variance:



Conduction delays:



Conduction delays:





Thank you for your kind
attention

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