Supplementary Materials

One strong synapse doesn't support runaway excitation. Both synapses have to be strong. Since our model neurons were easily sent to tonic spiking, it was the model-to-bio synapse strength that appeared to be most important in our data, however, it was necessary for both synapse strengths to be "sufficiently strong."

Supplementary Fig. 1A shows an example of a sufficiently strong model-to-bio synapse. During input I_{syn} (gray trace), V_{bio} (black trace) remains above threshold (dashed line). Fig. 1B shows a synapse that is too weak to support runaway excitation. These traces from PRC measurement protocols are representative of the super- or sub-threshold activity of the bio neuron while receiving strong or weak input, respectively.

It was necessary for both the model PRC and the biol. PRC to exhibit this behavior in order for runaway excitation to occur. This is one way we could determine *a priori* which networks would succumb to runaway excitation.

Figure Legends

Supplementary Figure 1. Critical strength of synapse for runaway excitation. Each panel shows the effect of one open loop stimulus from a partner model neuron (gray traces) on a free-running biological neuron (black traces). A: The model-to-bio synapse (100nS) extends the bio burst significantly (thick black bar), as determined by the burst threshold (dashed line). B: The model-to-bio synapse (30nS) does not extend the bio burst (thick black bar).