Supplemental materials

1. Supplemental methods: Computational simulation of FS networks in barrel cortex layer IV. Methods for computational simulations were described in the Materials and methods. The following paragraph contains additional information regarding how the computational simulation were constructed and performed.

The simulation consists of two spiny stellate cells (SS, see supplemental No.2) and two fast-spiking cells (FS, supplemental No. 3) connected with AMPA, NMDA or GABAa synapses. Two thalamic inputs are presently provided to each of the cells. After compiling the Neuron modification files (spike.mod and campump.mod), the files BarrelCortex.hoc and Barrelcortex.Ses are loaded in turn. One thalamic input " NetStim[0] at Thalamic[0].soma(0.5)" goes to the soma of both SS cells; while the other " NetStim[1]" goes to both FS cells. As seen above, the default is set with a 50 mSec. interspike interval for a total of 10 spikes starting at 50mSec. with no noise.

Wiring the simulation (see also Figure below)

There are six "primitive" procedures that connect the cells and the thalamic inputs to the cells:

TtoSS(ms) Thalamic inputs to both SS cells

TtoFS (ms) Thalamic inputs to both FS cells

FStoSS(ms): Both FS to both SS cells

FS toFS(ms) Both FS cells to each other but not to themselves

SStoFS(ms) Both SS cells to both FS cells.

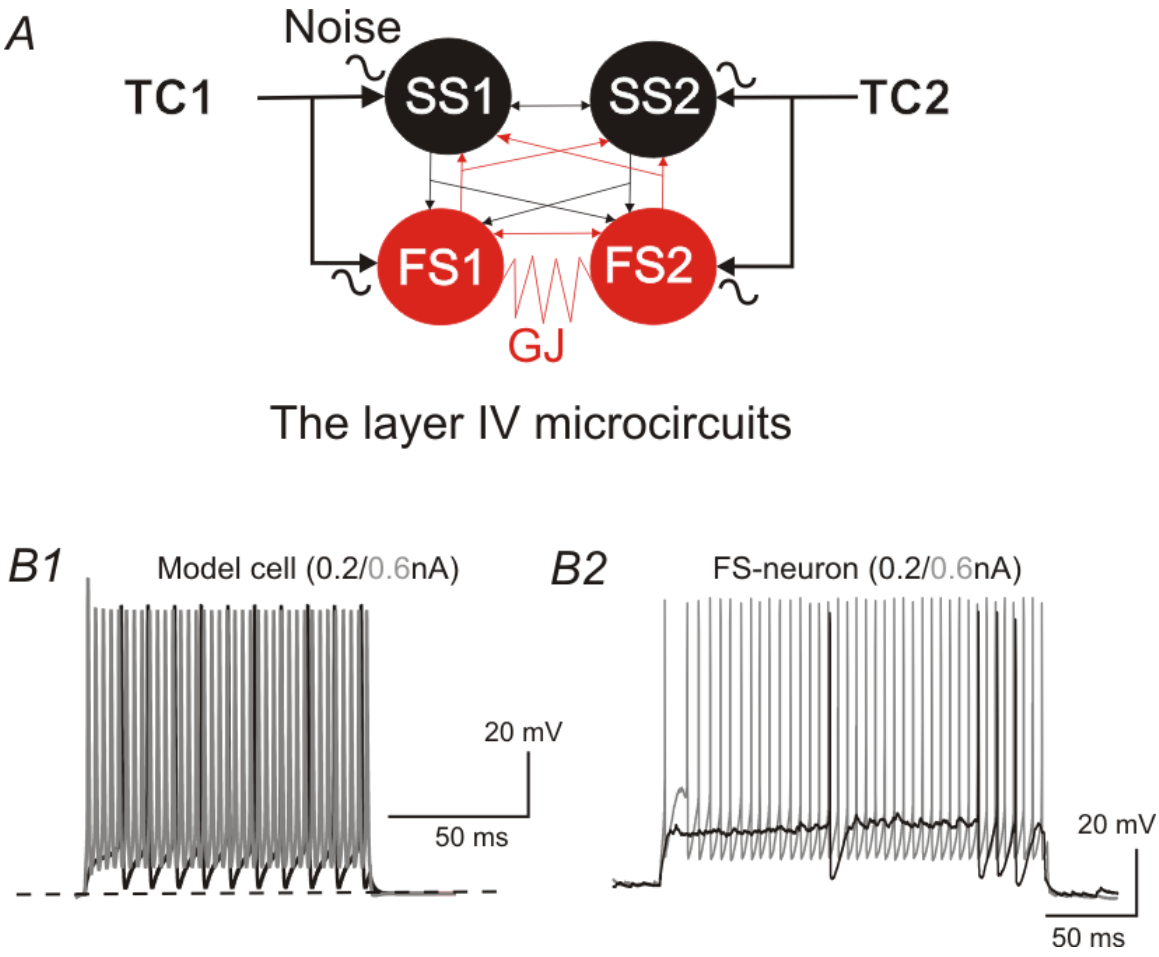


Figure legend: A) Circuit diagram showing how the simulation was constructed in a small microcircuits containing 4 cells (2S and 2 FS). B) Spikes were elicited by 0.2/0.6 nA in a model (B1) and real (B2) FS cells.

Supplemental Figure legend

Supplemental figure 1. Effects of whisker-trimming on firing pattern of RSNP interneuron. ***A)*** Action potentials elicited by long depolarizing currents (2s, 180 and 210 pA, respectively) in RSNP cells located in sensory-spared (***A1***,

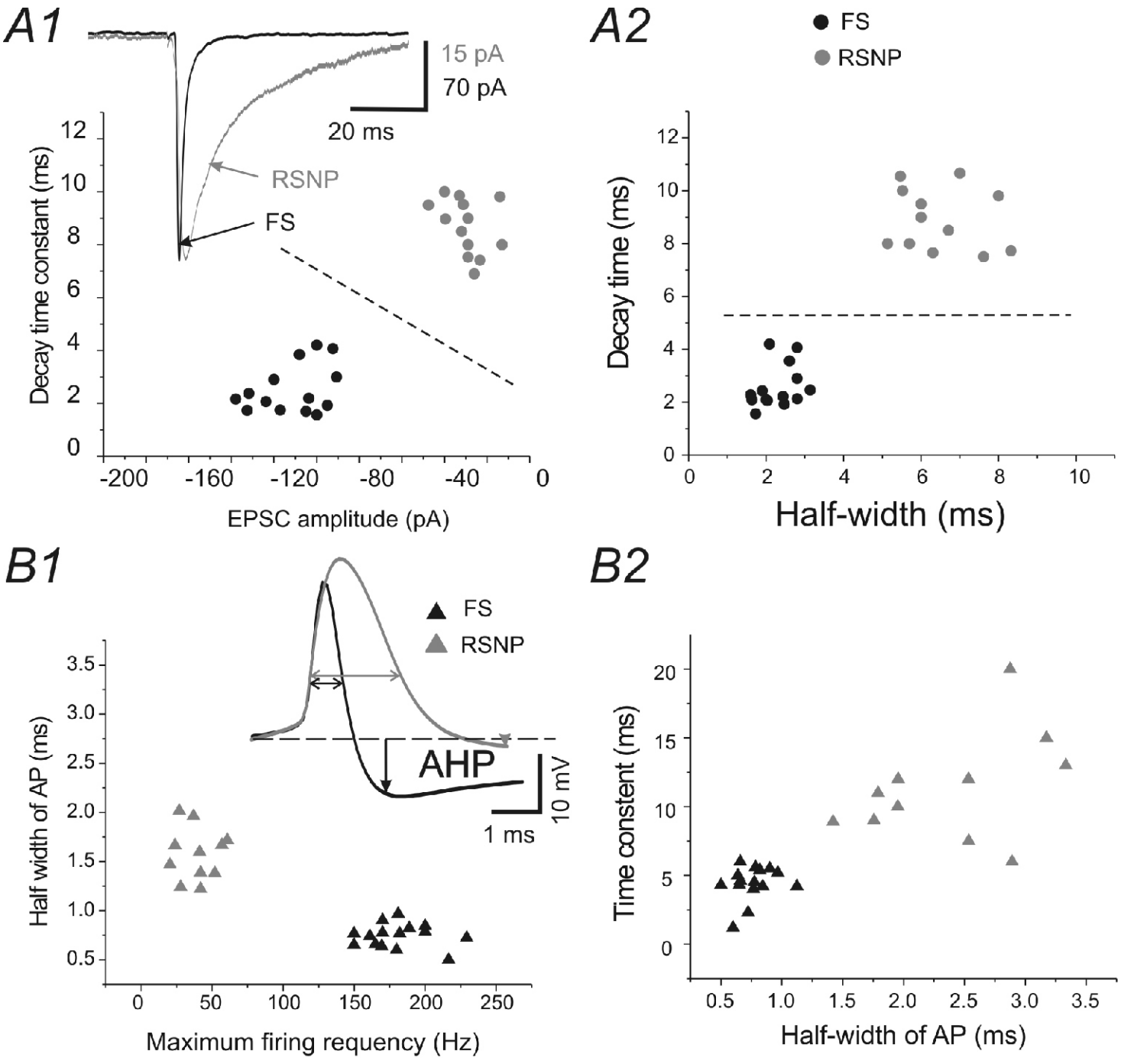
left) or deprived (***A2***, right) cortices. ***B)*** Representative recording showing the single action potential waveform (solid line) and its differentiated waveform (dotted line) in sensory-spared (***B1***) vs. deprived (***B2***) cortices. Scale bar indicate the voltage and time scale value for the action potential (20mV/1ms) and its dv/dt (40 mV/1ms), respectively. ***C)*** F-I plot: firing frequencies were plotted against currents. N=10 cells in each group (sensory-spared and sensory-deprived).

Supplemental figure 2. ***A)*** Examples of representative sEPSCs recorded in RSNP interneurons of control (***A1***), sensory-spared (***A2***) or sensory-deprived (***A3***) traces. Cumulative distribution of frequency of sEPSCs in the same RSNP (***A4***) cells. Cumulative distribution of amplitudes of sEPSCs in the same RSNP (***A5***) cells. Insets: example of averaged and normalized sEPSCs in control (black solid traces), sensory-spared (black dotted traces) and sensory-deprived (gray solid traces).

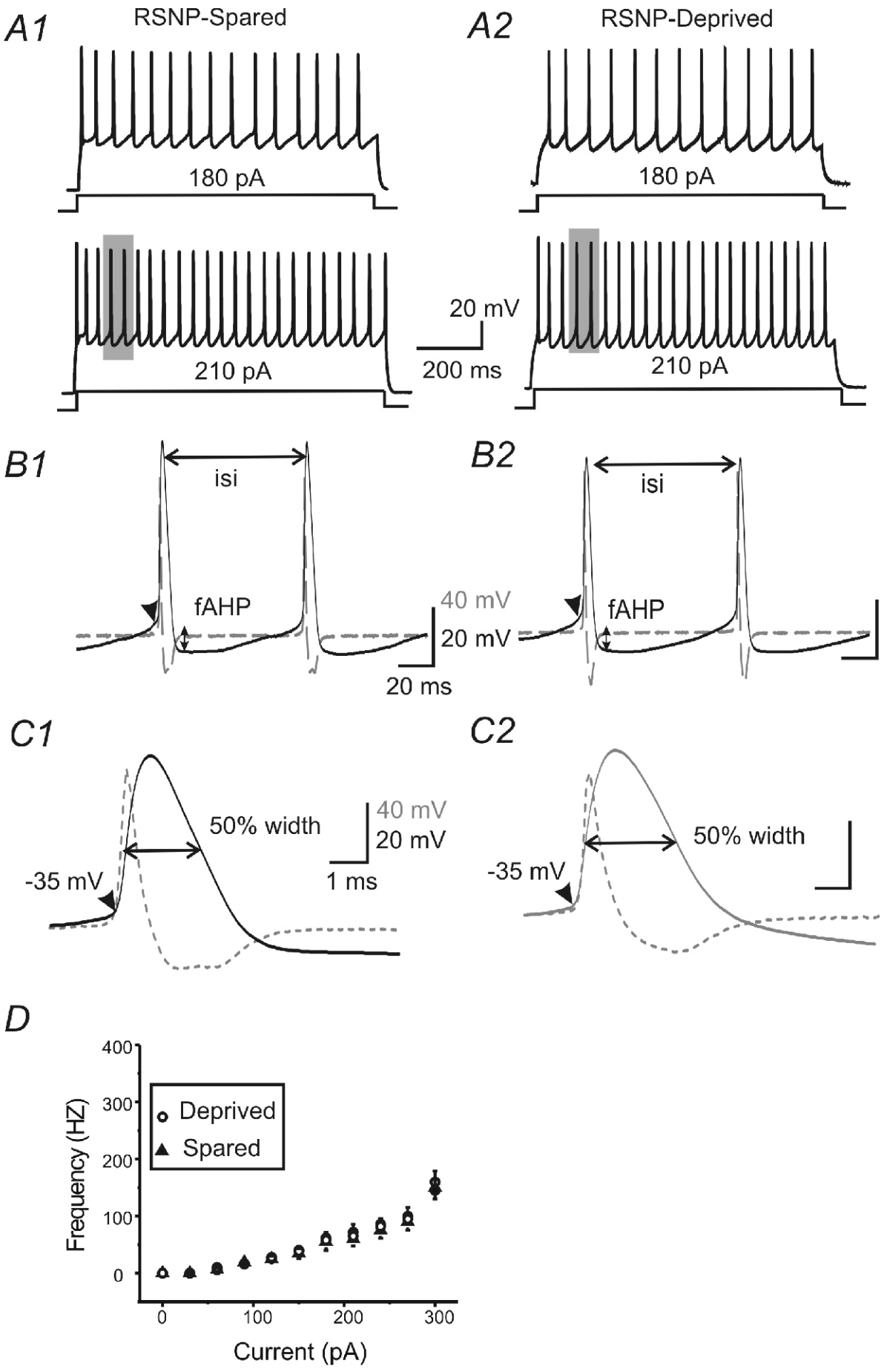
Supplemental figure 3. TC EPSCs recorded in FS cells in ACSF containing only picrotoxin. ***A)*** Membrane responses and action potentials induced by a depolarizing and a hyperpolarizing current in a FS cell. ***A2)*** 50 EPSCs traces induced by applying electrical stimulus at TC fiber in VB. Despite the presence of polysynaptic EPSCs (arrows), the monosynaptic TC EPSCs exhibited clear highly synchronous rise phase and the amplitudes can be measured.

Supplemental figure 4. Recording EPSCs and IPSCs from 'natural environment' (i.e. no pharmacological agents). A) sEPSCs and IPSCs

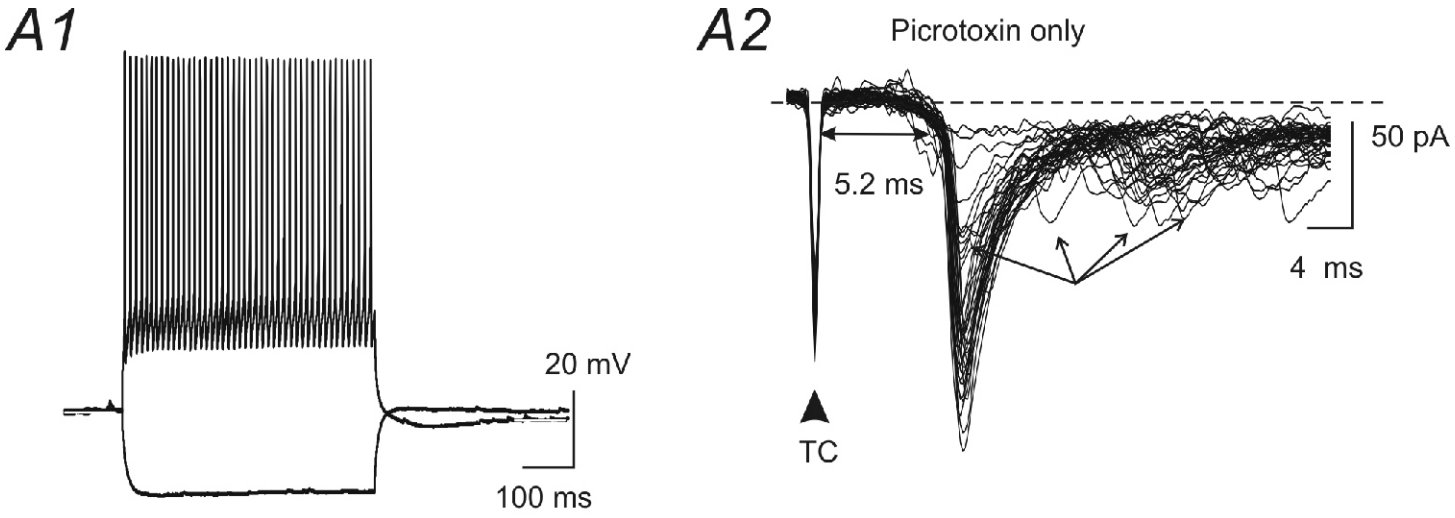
recorded from an FS (A1-3) and spiny neuron (A4). A1) sPSPs were recorded at holding potential of -60 mV (where reversal potential of IPSCs was) with a k-gluconate based pipette. Although most of the events appeared to be negative-going events, these events are composed of both IPSCs and EPSCs. A2) An sEPSC event from A1, note the event was fast, with decay tome constant (gray solid line are the single exponential fitting curve) of 6 ms. A3) An sIPSC event from A1, note that the event was much larger in amplitude, wider and slower, with decay time constant (29ms). A4) TC-evoked PSPs had a mixed EPSP and IPSP component. Note that at -40 mV, IPSCs begin reversed in direction. Also note that IPSCs mask the EPSP event. **B)** Simultaneous recordings sPSPs from two cells, a spiny cell and a FS cell. B1) Note in spiny neuron (top), there were more IPSPs than FS cells (bottom). B2) Similarly, there were stronger evoked IPSPs in spiny cells.



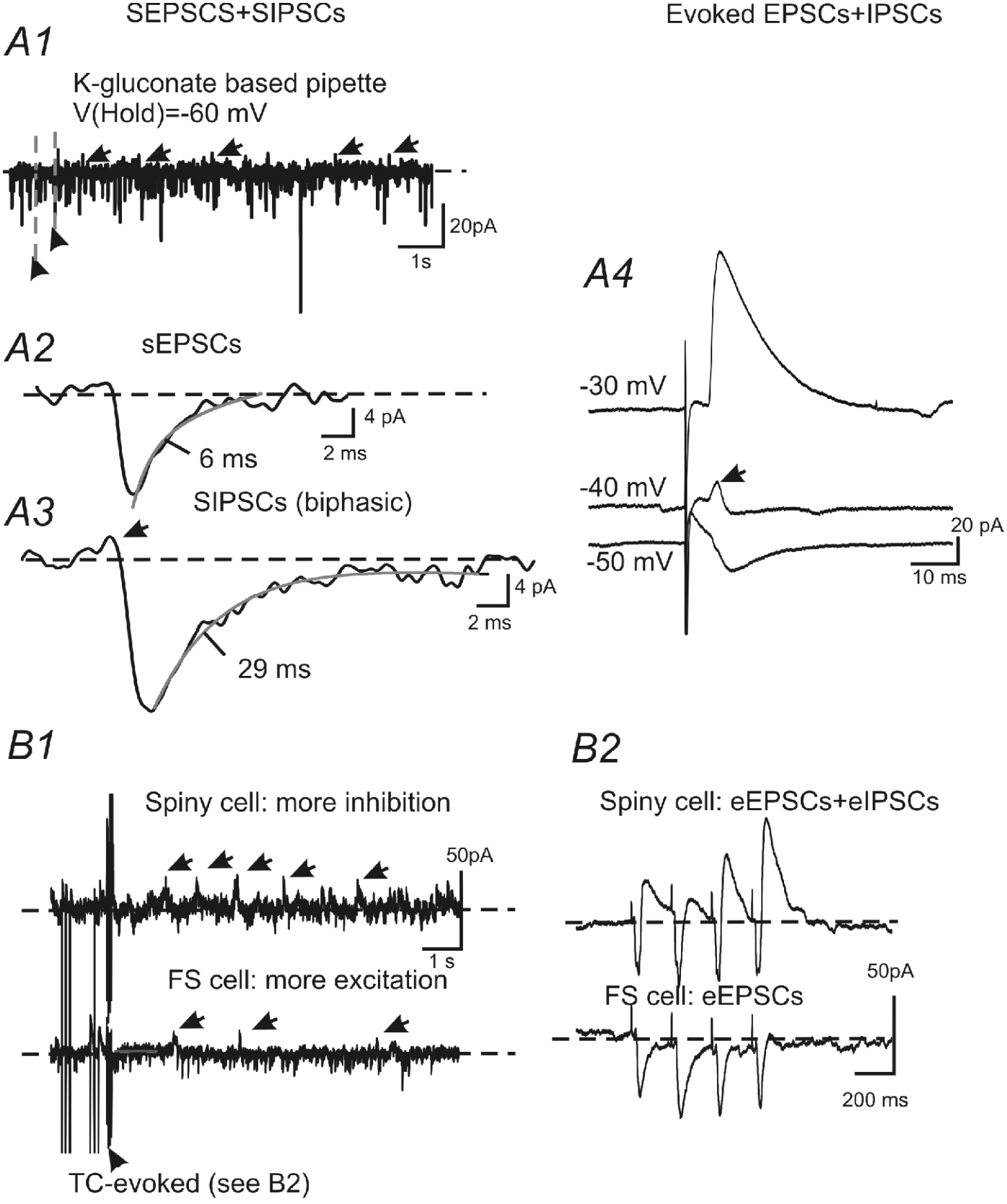
Sun, Supplemental fig 1



Sun, Supplemental fig 2



Sun Supplemental Fig 03



Sun, Supplemental fig 04