**Key papers**

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| --- | --- | --- | --- | --- |
|  | **Species** | **Age** | **Temperature** |  |
| LeFort ([Lefort et al., 2009](#_ENREF_5)) | Mouse | 18-21 | 35 |  |
| Feldmeyer ([Feldmeyer et al., 2005](#_ENREF_4)) | Rat | 17-23 | 35 |  |
| Beierlein ([Beierlein et al., 2003](#_ENREF_1)) | Rat | 14-21 | 32 |  |
| Cruikshank ([Cruikshank et al., 2007](#_ENREF_3)) | Mouse | 13-16 | 32 |  |
| Ma ([Ma et al., 2012](#_ENREF_6)) | Mouse | 15-23 | 32 |  |
| Bruno ([Bruno and Sakmann, 2006](#_ENREF_2)) (in vivo) | Rat |  | 38 |  |
| Jianing (in vivo) | Mouse | > 2 months | 38 |  |
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**L4 stellate cell parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ([Lefort et al., 2009](#_ENREF_5)) | ([Beierlein et al., 2003](#_ENREF_1)) | ([Cruikshank et al., 2007](#_ENREF_3)) | Jianing (in vivo) |
| **Number** of neurons in C2 barrel | 1600 |  |  |  |
| **Resting** **potential** (leak reversal) (mV) | -66 | -66 | -79 | ~ -66 |
| Action potential **threshold** (mV) | -40 |  | -51 | - 45 |
| **Reset** after action potential(mV) |  |  |  |  |
| **Reversal** for **excitatory** transmission(mV) | 0 | 0 |  |  |
| **Reversal** for **inhibitory** transmission (mV) | -73 | -73 |  |  |
| Neuronal **membrane time constant** (ms) | 35 | 20 |  | 10 |
|  |  |  |  |  |
| Key conclusions: resting potentials, -66; threshold -40; n=1600  Membrane time constants in vivo are 2-3.5 times shorter in vivo | | | | |

**FS neuron parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ([Lefort et al., 2009](#_ENREF_5)) | ([Beierlein et al., 2003](#_ENREF_1)) | ([Cruikshank et al., 2007](#_ENREF_3)) | Jianing (in vivo) |
| **Number** of neurons in C2 barrel | 200 |  |  |  |
| **Resting** **potential** (leak reversal) (mV) |  | -64 | -78 |  |
| Action potential **threshold** (mV) |  |  | -48 |  |
| **Reset** after action potential(mV) |  |  |  |  |
| **Reversal** for **excitatory** transmission(mV) | 0 |  |  |  |
| **Reversal** for **inhibitory** transmission (mV) | -73 |  |  |  |
| Neuronal **membrane time constant** (ms) |  | 10 |  |  |
| Key conclusions | resting potentials, -64; threshold -40; n=200  Membrane time constants are 2 times shorter for FS cells than for RS cells. | | | |

**VPM spike trains**

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| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| **Number** of neurons in C2 barreloid | 200 |  |  |  |
| Mean spike rate (Hz) |  |  |  |  |
| Modulation depth with whisking |  |  |  |  |
| Modulation frequency (Hz) |  |  |  |  |
| Number touch-evoked spikes |  |  |  |  |
| Touch-evoked spikes latency (ms) |  |  |  |  |
| Touch-evoked spikes latency jitter (ms) |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**VPM – l4 stellate synapses**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ([Bruno and Sakmann, 2006](#_ENREF_2)) | ([Beierlein et al., 2003](#_ENREF_1)) | ([Cruikshank et al., 2007](#_ENREF_3)) |  |
| **Connection probability** | 0.5 |  |  | median – adapted! |
|  |  |  |  |  |
| Peak **synaptic conductance** change per AP (nS) |  |  | 0.7 | Cruikshank – likely biased because min stimulation |
| PSP amplitude (mV) | 0.5 | 2.4 +- 2 |  |  |
| Decay time-constant, synaptic current (ms)\*\* |  |  | ~ 3 |  |
| Peak Synaptic conductance, cs (uF/cm^2) |  | **0.04** |  | 2mV / ts=3 / to = 20/ dV=70 |
| Rise-time, synaptic current (ms) |  |  |  |  |
| Latency to peak for (ms) |  |  |  |  |
| Key conclusions | Used the Beierlein numbers. The Bruno paper suggests that depression likely decreases this synaptic weight and this is likely the case. However, the Bruno size is likely diminished by lower input impedance also. Depression could be modeled by decreasing all synapses by 2x. | | | |

**VPM – FS synapses**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ([Beierlein et al., 2003](#_ENREF_1)) | ([Cruikshank et al., 2007](#_ENREF_3)) |  |  |
| **Connection probability** |  | 0.75 |  | Cruikshank indicates that the cp is higher than for VPM-l4 |
| Peak **synaptic conductance** change per AP (nS) |  | 3 |  | Cruikshank – likely biased because min stimulation |
| Peak **psp (mV)** | 4.1 +- 3 |  |  |  |
| Decay time-constant, synaptic current (ms) |  | ~ 3 |  |  |
| Peak Synaptic conductance, cs (uF/cm^2) |  | **0.1** |  | 4mV / ts=3 / to = 10/ dV=70 |
| Rise-time, synaptic current (ms) |  |  |  |  |
| Key conclusions | Used the Beierlein numbers. Same issue as above wrt to depression. Cruikshank suggests that the ration of synaptic conductances (vpm🡪fs / vpm 🡪ss) is more like 4 rather than 2.5. | | |  |

**l4 – l4 stellate synapses**

**Beierlein – RS – RS epsps ½ of RS – FS epsps**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ([Lefort et al., 2009](#_ENREF_5)) | ([Beierlein et al., 2003](#_ENREF_1)) | ([Feldmeyer et al., 2005](#_ENREF_4)) |  |
| **Connection probability** | 0.25 |  |  |  |
|  |  |  |  |  |
| Peak epsp (mV) | 0.52 (0.06 – 7.8) | 1.1+-1.1 | 1.6+-1.6 | slice, mouse |
| Decay time-constant, synaptic current (ms) |  |  |  | ~ 3 |
| Peak Synaptic conductance, cs (uF/cm^2) |  | **0.02** |  | 1mV / ts=3 / to = 20/ dV=70 |
| Key conclusions | Again used the Beierlein numbers for consistence. Depression is probably less severe because of the low firing rate. | | |  |

**l4 – fs synapses**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ([Beierlein et al., 2003](#_ENREF_1)) |  |  |  |
| **Connection probability** | 0.5 |  |  |  |
| Peal psps (mV) | 2.2+-2.2 |  |  |  |
| Time-constant of synaptic current (ms) |  | ~ 3 |  |  |
| Peak Synaptic conductance, cs (uF/cm^2) |  | **0.05** |  | 2mV / ts=3 / to = 10/ dV=70; seems big |
| Key conclusions | Beierlein numbers are the only useful ones. Depression is probably less severe because of the low firing rate. | | |  |

**fs – l4 stellate synapses**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | ([Beierlein et al., 2003](#_ENREF_1)) | ([Ma et al., 2012](#_ENREF_6)) |  |
| **Connection probability** |  | 0.5 | 0.63 |  |
| Peak psp (mV) |  | 1.1 (drive 20 mV) | 1.0 (drive 25 mV) |  |
|  |  |  |  |  |
| Time-constant of synaptic current (ms) |  |  | 3.9 |  |
| Peak Synaptic conductance, cs (uF/cm^2) |  | **0.06** |  | 1mV / ts=3 / to = 20/ dV=25 |
| Key conclusions | Beierlein numbers / Ma numbers identical. Depression could play a big role here | | |  |

**fs – fs synapses**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | ([Ma et al., 2012](#_ENREF_6)) |  |
| **Connection probability** |  |  | 0.5 |  |
| Peak u\_upsc (pA) |  |  | 80 (V-Vr = 25 mV) |  |
| Peak u\_psp (mV) |  |  | 1.8 (V-Vr = 25 mV) |  |
| Time-constant of synaptic current (ms) |  |  | 2.3 |  |
| Peak Synaptic conductance, cs (uF/cm^2) |  |  | **0.12** | 1.8mV / ts=3 / to = 10/ dV=25 |
| Key conclusions | Ma numbers. Depression could play a big role here. | | |  |

**In vivo measurements L4 (Jianing)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | JY0532 | JY0544(620um) | JY0781 | JY0819 | JY0861 | JY0865 | JY0520 |
| mean Vm | -65 | -66 | -64 | -58 | -75 | -59 | -57 |
| resting Vm (5th percentile) | -70 | -70 | -68 | -67 | -82 | -64 | -61 |
| membrane constant (ms) | 10.2 | 3.1 | 6.3 | 12.7 | 10.9 | 7.1 | 4.6 |
| AP threshold (10th percentile) | -42 | na | -45 | -46 | -49 | -45 | na |
| membrane resistance (Mohm) | 30 | 75 | 55 | 223 | 140 | 90.7 | 16.4 |

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