**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**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| **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 |  |
| Rise-time, synaptic current (ms) |  |  |  |  |
| Latency to peak for (ms) |  |  |  |  |

**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 |  |  |
| Rise-time, synaptic current (ms) |  |  |  |  |
|  |  |  |  |  |

Key conclusions:

1. The unitary conductance VPM 🡪 FS is 4x bigger than VPM 🡪 RS
2. Connection probability is 0.5 for VPM 🡪 RS; 0.75 VPM 🡪 FS
3. **Key question is: what’s the correct value for ge for VPM 🡪 RS; All slice data have to be corrected by factor of 2-3 for depression.**

**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 |

**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 |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**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 |  |
|  |  |  |  |  |
|  |  |  |  |  |

**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 |  |
|  |  |  |  |  |
|  |  |  |  |  |

**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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