

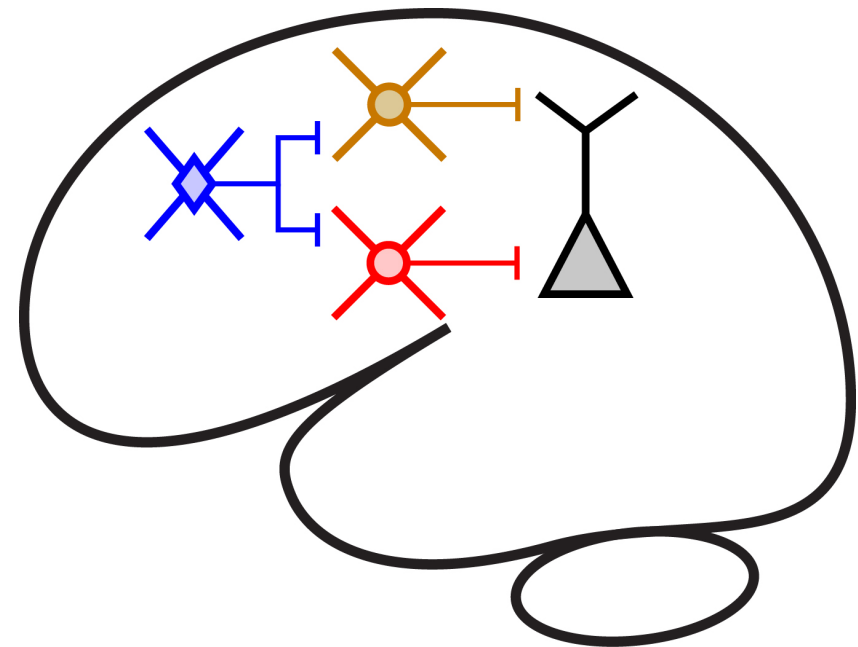
5.5 Neocortical inhibition

Cellular Mechanisms of Brain Function

Prof. Carl Petersen

GABAergic inhibition in the neocortex

Inhibitory GABAergic neurons of the neocortex

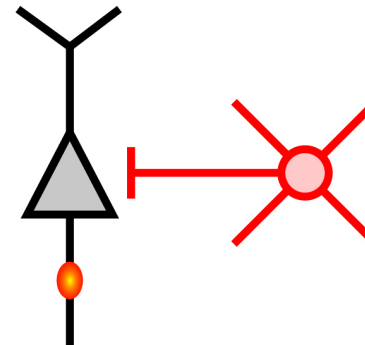
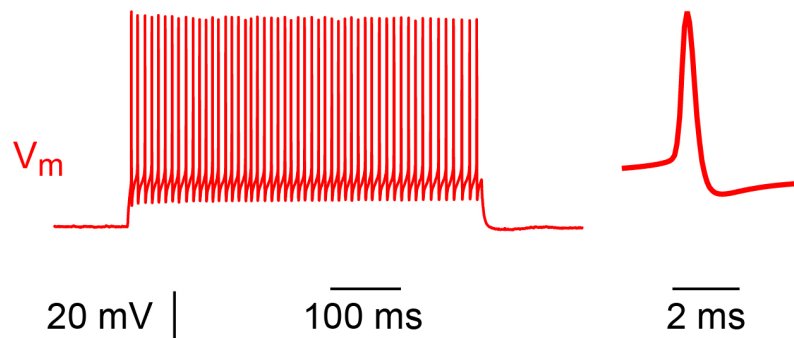


Four examples of neocortical GABAergic neurons

1. Parvalbumin-expressing
2. Somatostatin-expressing
3. Vasoactive intestinal peptide-expressing
4. Neurogliaform cells

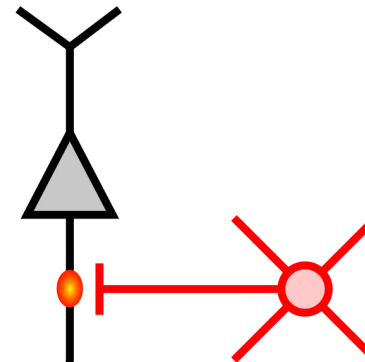
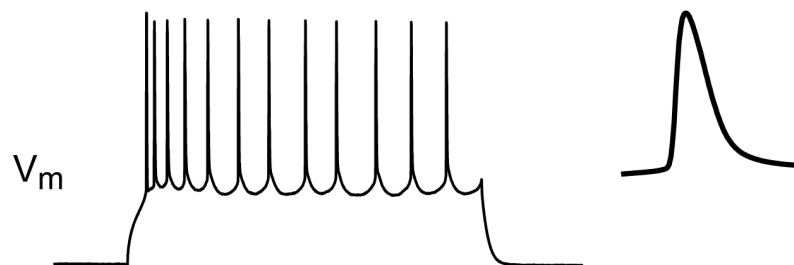
1. Fast-spiking, parvalbumin-expressing cells

Fast-spiking GABAergic neuron



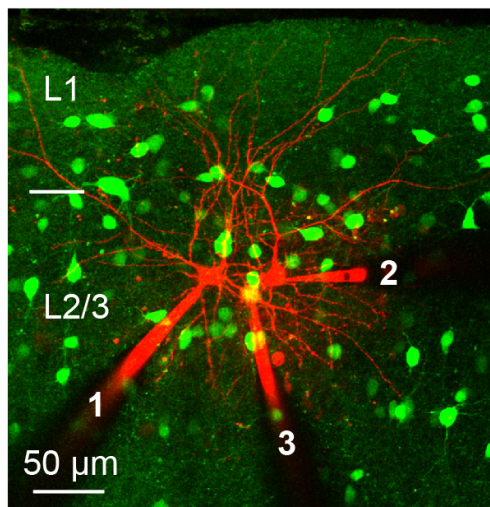
1. Axon innervates soma and proximal dendrites

Glutamatergic pyramidal neuron

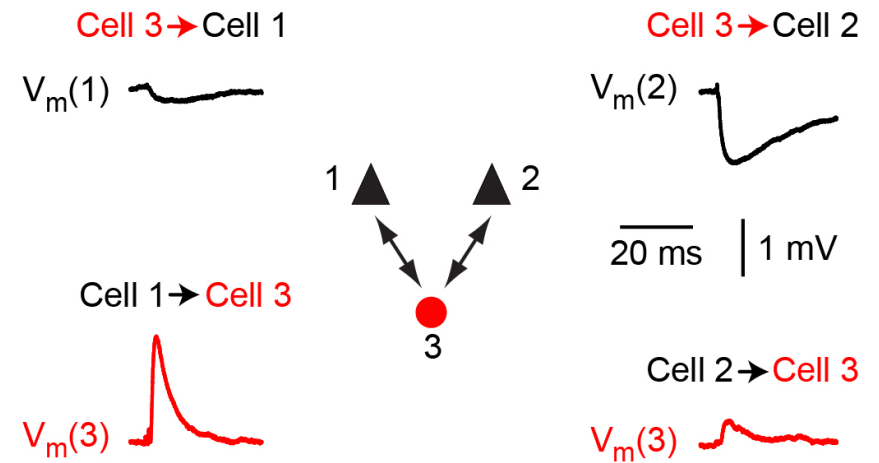
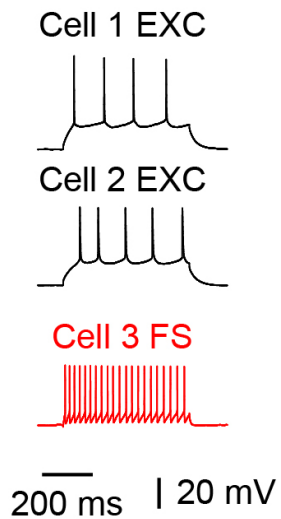


2. Makes synapses on the axon initial segment

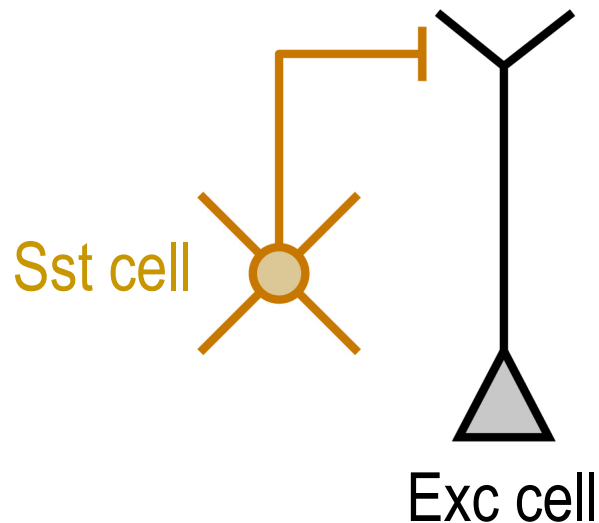
Excitatory and inhibitory microcircuits



Avermann, Tomm, Mateo, Gerstner & Petersen, 2012



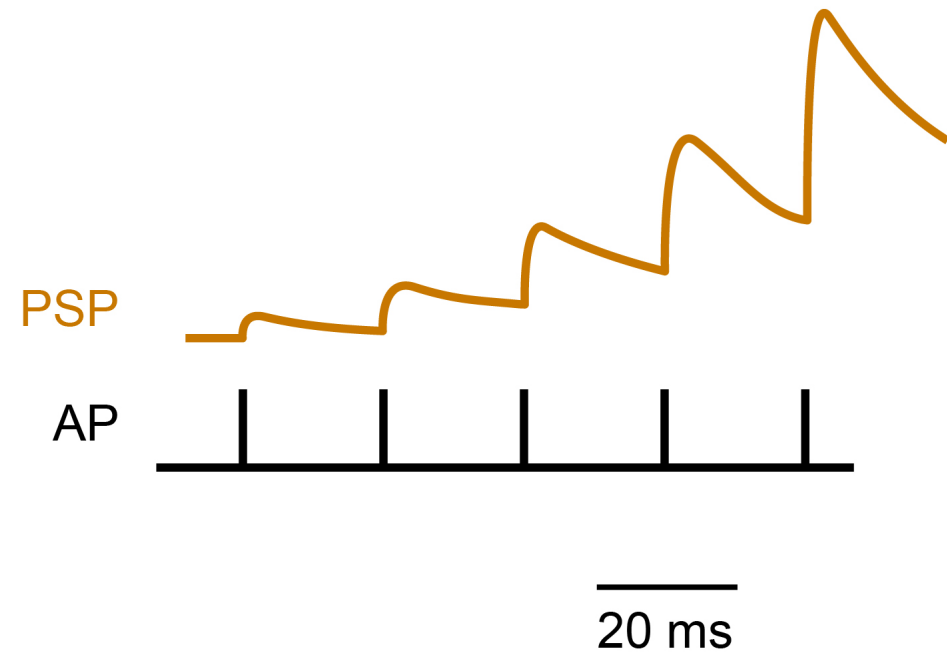
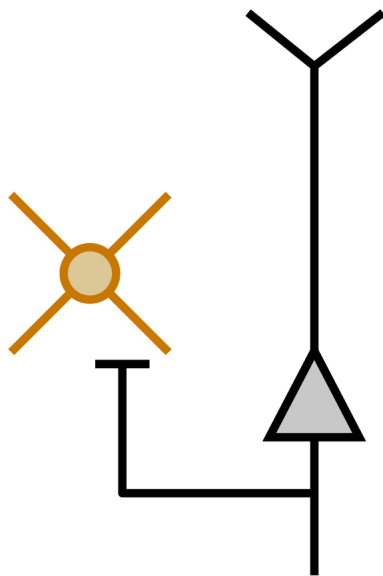
2. Somatostatin-expressing GABAergic neurons



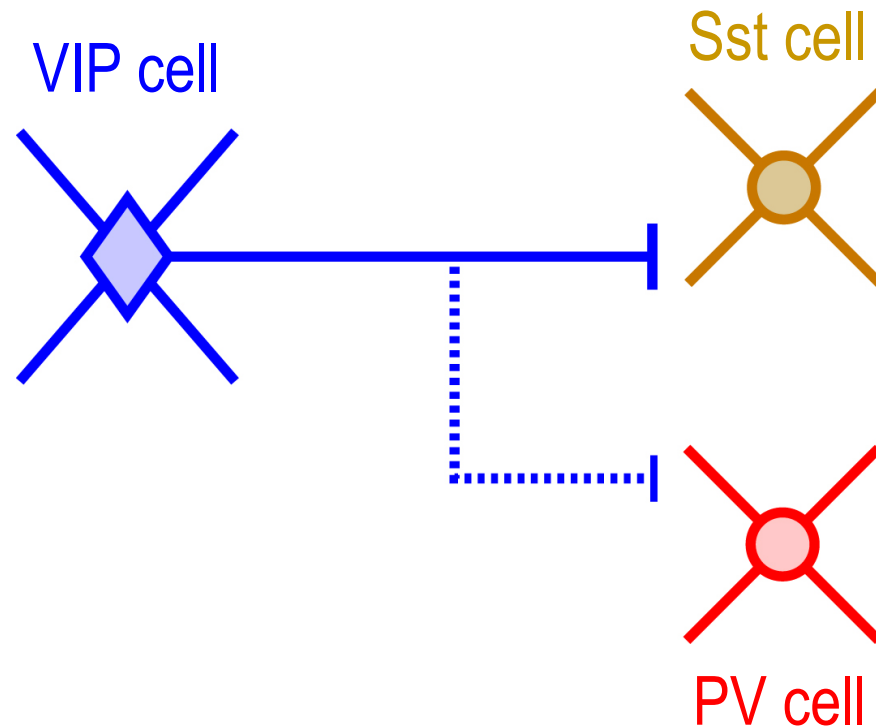
Somatostatin-expressing (Sst) GABAergic neurons of the neocortex strongly innervate distal dendrites of excitatory (Exc) pyramidal neurons.

Sst cells - distal dendritic inhibition

Facilitating excitatory synaptic input to Sst cells



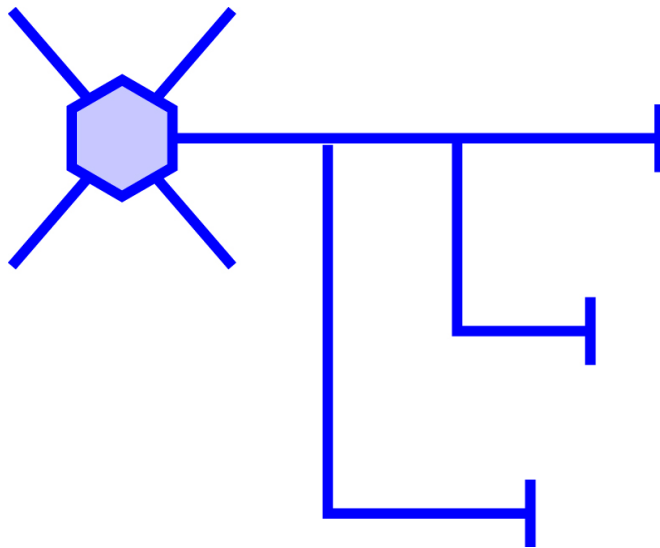
3. VIP-expressing GABAergic neurons



Vasoactive intestinal peptide-expressing (VIP) GABAergic neurons inhibit other inhibitory neurons, especially Sst neurons.

VIP cells – dis-inhibition

4. Neurogliaform GABAergic neurons



Neurogliaform cells release GABA into the extracellular space, thereby mediating volume transmission activating GABA_BRs to drive slow IPSPs.

GABAergic neurons of the neocortex

- Most GABAergic neurons in the neocortex only have a local axon.
- PV neurons inhibit proximally
- Sst neurons inhibit distally
- VIP neurons dis-inhibit
- Neurogliaform cells inhibit via extrasynaptic GABA_B receptors