Investigating the activity dependent dynamics of synaptic structures using biologically realistic modelling of peripheral lesion experiments

Discussion of my Ph.D. research

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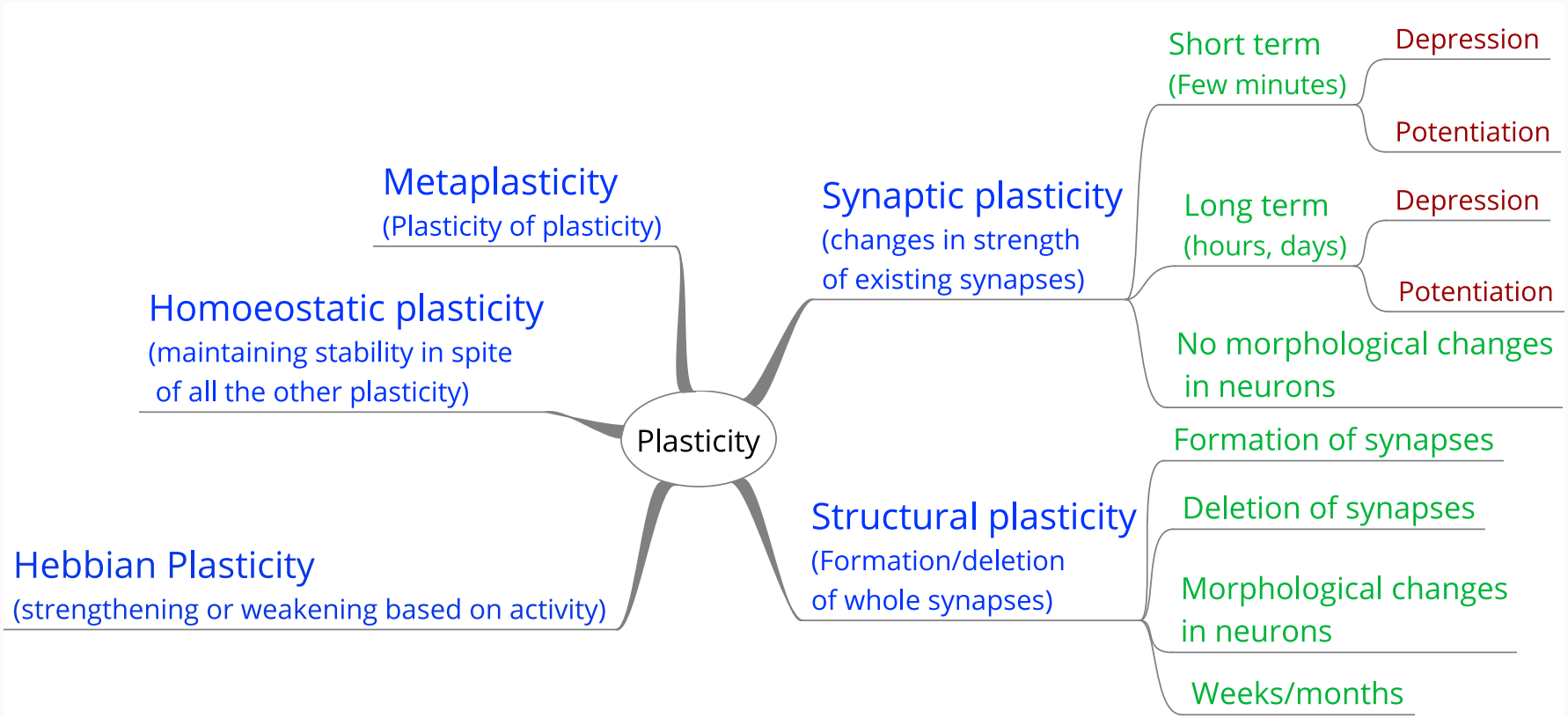
Context

Plasticity while maintaining stability



Structural plasticity in the adult brain

- All synaptic structures: axonal branches, boutons[1], dendritic structures[2] in the adult brain are dynamic.

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[1] Chen, J. L. *et al.* Structural basis for the role of inhibition in facilitating adult brain plasticity. *Nature neuroscience* **14,** 587–594 (2011)

Marik, S. A. *et al.* Axonal dynamics of excitatory and inhibitory neurons in somatosensory cortex. *PLoS Biology* **8,** e1000395 (2010)

Marik, S. A. *et al.* Large-scale axonal reorganization of inhibitory neurons following retinal lesions. *Journal of Neuroscience* **34,** 1625–1632 (2014)

Stettler, D. D. *et al.* Axons and Synaptic Boutons Are Highly Dynamic in Adult Visual Cortex. *Neuron* **49,** 877–887. ISSN: 0896-6273 (2006)

Gogolla, N. *et al.* Structural plasticity of axon terminals in the adult. *Current opinion in neurobiology* **17,** 516–524 (2007)

[2] Holtmaat, A. J. G. D. *et al.* Transient and Persistent Dendritic Spines in the Neocortex In Vivo. *Neuron* **45,** 279–291. ISSN: 0896-6273 (2005)

Chen, J. L. *et al.* Clustered dynamics of inhibitory synapses and dendritic spines in the adult neocortex. *Neuron* **74,** 361–373 (2012)

Trachtenberg, J. T. *et al.* Long-term in vivo imaging of experience-dependent synaptic plasticity in adult cortex. *Nature* **420,** 788–794 (2002)

Villa, K. L. *et al.* Inhibitory Synapses Are Repeatedly Assembled and Removed at Persistent Sites In Vivo. *Neuron* **89,** 756–769. ISSN: 1097-4199 (4 Feb. 2016)

Activity dependent structural plasticity

- Hebbian structural plasticity is

Methods

Results and discussion