Corticosterone hampers NMDA-receptor-dependent synaptic plasticity

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The hippocampus is essential for the formation of memory (both in humans and animals) Memories can be formed in less than a second and they can last a lifetime. A model based on this theory is called long term potentiation (LTP)
Stress is an important regulator of the memory trace formation. During stressful situations the adrenal hormone corticosterone (CORT) secretion is up regulated. Corticosteroid-hormones modulate brain function via the local mineralo- and glucocorticoid receptors (MR and GR respectively) These receptors differ o.a in affinity for corticosterone (i.e the GR has a 10-fold lower affinity for corticosterone than the MR). Earlier we showed that in animals exposed to stressful experiences LTP is hampered.
Calcium entering the cell via different routes, e.g. N-methyl-D-aspartate receptors (NMDAr) or voltage-dependent calcium channels (VDCC), plays a pivotal role in hippocampal synaptic potentiation The NMDAr is activated by means of glutamate binding in combination with substantial depolarisation. VDCC-activation requires a longer postsynaptic depolarization resulting in activation of calcium channels.
Using a reductionistic approach we examined (i) how corticosterone modulates hippocampal synaptic plasticity using different stimulus paradigms (presumably activating different forms of synaptic plasticity), and (ii) the role of the glucocorticoid receptor in these effects. Therefore mouse hippocampal slices were treated for 20 minutes with corticosterone (100 nM) or vehicle and synaptic efficacy was examined 1-4 hrs later. Our results show that corticosterone selectively hampers NMDA-receptor-dependent forms of synaptic plasticity. Studies on the role of the glucocorticoid receptor, by means of a pharmacological and transgenic approach, are in progress.

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