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Investigating the effects of hydrocortisone and d-cycloserine on motor sequence learning and reward learning

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The two pharmacological agents hydrocortisone and d-cycloserine have been found to play an important role in learning and memory. Although much is known about the neurobiological effects of hydrocortisone, especially under stress-related conditions, and the effects of d-cycloserine, especially with respect to fear conditioning and extinction, the influence of these two agents on specific kinds of learning, such as motor sequence learning or reward learning, have remained relatively unexplored.
Previous research suggests that both agents have a potential to be used in the treatment of mental disorders, especially when used in combination with other therapy regimes, for example with cognitive behavioural therapy. For this purpose, it is important to know which specific processes of learning and memory in humans are affected, and which are not affected by each of these two drugs.
The research project presented in this thesis explored the effects of hydrocortisone and d-cycloserine on learning in healthy human subjects, by testing whether single low-dose administration of these drugs had an effect on motor sequence learning or reward learning in humans. 74 participants were tested in a double-blind, placebo-controlled design, using a motor sequence learning task and a reward learning task after oral administration of 20 mg hydrocortisone, 250 mg d-cycloserine or placebo. Additional cognitive effects related to information processing and decision making were examined in an exploratory analysis.
The experimental results demonstrated no significant effect of hydrocortisone for motor sequence learning or for reward learning, but significant effects of d-cycloserine in both tasks on information processing and decision making. In the motor sequence learning task, d-cycloserine moved responding towards slower but more accurate responding, indicating a shift in speed-accuracy trade-off, in the absence of a direct learning effect. These results complement the previously published finding that in the reward learning task d-cycloserine shifted decision making towards a more optimal integration of learnt and explicitly shown information, also in the absence of a direct learning effect.
The results suggest that hydrocortisone and d-cycloserine differ in their effects on information processing and integration, independent of overall performance in both tasks. Thereby, the effect of d-cycloserine on decision making is a promising avenue for future research on drug-dependent enhancement of cognitive behavioural therapy.