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Long-lasting memories depend upon gene transcription for their continued expression. One of the plasticity mechanisms that may contribute to cerebellum-dependent learning is LTD at the parallel-fiber to Purkinje cell synapse. In cultured Purkinje cells, long-lasting LTD depends upon the activity of CaMKIV and CREB (Ahn, et. al., 1999; Ho., et. al., 2000). We are examining the contribution of CaMKIV to cerebellum-dependent memory by studying motor learning in the vestibulo-ocular reflex (VOR), a simple eye movement behavior.

In mice, 30 minutes of training can induce an increase or decrease in the gain of the VOR that persists for at least 24 hours. Acquisition of a learned increase in gain is normal in CaMKIV knockout mice, but retention of the motor memory is impaired when measured 24 hours after training (n = 8 ko; n = 9 wt). In contrast to our results for an increase in gain, preliminary experiments suggest that retention of a learned decrease in VOR gain is not dramatically impaired in CaMKIV mice. Our results point to a role for CaMKIV in a late phase of expression of motor memory in the VOR, in particular for an increase in VOR gain.

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