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The role of the cerebellar cortex in different forms of learning and memory

Understanding the brain mechanisms of learning and memory is important for understanding the neurological basis of disorders of memory. Our work focuses on the cerebellum, using rat models. We make use of a laboratory model of learning and memory, eyeblink conditioning (EBC), which is known to require the cerebellum. The simplest form of EBC, delay EBC, involves trials in which a tone stimulus precedes an eyelid stimulation by half a second. Rats learn to make an eye blink to the tone in anticipation of the eyelid stimulation. A second form of EBC, trace EBC, involves trials in which a tone stimulus ends a quarter of second before the eyelid stimulation. Trace EBC requires other brain regions that are important for learning and memory in addition to the cerebellum, but it is not clear whether or not it engages the cerebellum in the same way as delay EBC. Answering this question will provide clues as to how the cerebellum interacts with other brain regions during learning and memory. Secretin is a neuropeptide that is found in high concentrations within the cerebellum. We have previously shown that blocking secretin’s effects in the cerebellum with intra-cerebellar infusion of a secretin receptor antagonist impairs delay EBC. The present study compared the effects of intra-cerebellar infusion of a secretin receptor antagonist or vehicle on delay EBC vs trace EBC. Rats underwent 6 sessions of delay or trace EBC, with 100 trials per session. Infusions were made immediately prior to sessions 1 and 2. We predict that rats receiving the secretin receptor antagonist will show slower learning of either delay or trace EBC, compared to rats receiving vehicle. This would support the idea that the cerebellum treats these two forms of EBC identically, despite the fact that they are treated differently by brain areas outside the cerebellum.