Enhanced Pavlovian Trace and Delay Fear Conditioning in GABA<sub>α1</sub> R Subunit α1 KO Mice

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INTRODUCTION

In standard auditory fear conditioning a tone conditional stimulus (CS) is presented and immediately followed by a footshock unconditional stimulus (US). In this delay conditioning procedure shock onset is contiguous with the tone CS and fear of both the tone and the conditioning context is acquired. Amygdala lesions block both context and auditory delay fear conditioning, while hippocampal lesions block only context fear, sparing fear of the tone.

Several lines of evidence indicate that plasticity at the synapses carrying auditory information from the medial genulate nucleus (MGN) and auditory cortex to the lateral nucleus of the amygdala (LA) supports auditory delay conditioning, while plasticity of the hippocampal input to the basolateral nucleus (BLA) supports context fear conditioning (Lamprecht et al., 2009; Menen & Fanselow, 1995; Rejmers et al., 2007; Romanski & LeDoux, 1992). In support of this view, deletion of the α1 subunit of the GABA<sub>α</sub>R, which is highly expressed in the lateral but not basal nucleus (see Figure 1), enhances auditory delay but not context conditioning (Wiltgen et al., 2009).

In auditory trace conditioning a brief stimulus-free interval is placed between termination of the tone CS and the onset of the shock US. Unlike delay conditioning, trace conditioning is dependent on both the hippocampus and amygdala. In this way, trace conditioning is more like context than delay conditioning. This raises the question of how auditory information for the trace CS is communicated to the amygdala, is it communicated via hippocampal input to the BLA like context information? Or does the auditory trace conditioning procedure (see Figure 3) to investigate the role of GABA<sub>α1</sub> in each of these two learning processes.

METHODS

This study used global GABA<sub>α1</sub> R α1/−/− KO mice, which had a cre transgene and were homozygous for an α1 null allele (see Vinci et al., 2001). Control mice were α1 homozygous wild types (WT). Subjects consisted of 16 KO mice (trace conditioning n=9 and delay conditioning n=7) and 23 WT controls (trace conditioning n=12 and delay conditioning n=11).

Subjects were trained in either a trace or delay auditory fear conditioning procedure (see Figure 3) to investigate the role of GABA<sub>α1</sub> in each of these two learning processes.

RESULTS

**CONCLUSIONS**

- The selective enhancement in both trace and delay tone conditioning in the α1 KO mice may be a result of decreased inhibitory currents in the LA. The LA provides auditory input into the amygdala and has been shown to have more α1 expression than the BLA which receives input from incoming hippocampal projections.

- Furthermore, an enhancement in both trace and delay conditioning groups suggests that auditory cues in both tasks may rely on similar pathways into the amygdala.

- In the trace conditioning task the hippocampal inputs into the BLA may be additionally modulating the auditory inputs into the amygdala.

REFERENCES


