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Presentation Abstract

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Presentation Title: Involvement of the neural pathway from the central nucleus of amygdala projecting to the hypothalamic paraventricular nucleus in yawning responses accompanied by conditioned fear in rats

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Abstract: Yawning is often observed in not only the state of boredom or drowsiness but also a stressful situation. Previous studies have shown that anxiogenic treatments, which can potentially induce anxiety- and fear-like behaviors, are often accompanied by yawning responses in monkeys. This indicates that yawning is an emotional behavior related to anxiety or fear. However, the neural mechanisms underlying yawning responses as the emotional behavior have not been determined. We have reported that activation of oxytocin (OT) neurons and corticotropin-releasing factor (CRF) neurons in the hypothalamic paraventricular nucleus (PVN) is responsible for the induction of yawning behavior. Thus, it is possible that yawning as the emotional behavior is induced through a neural pathway from the amygdala to the PVN, since it is known that the anxiety- and fear-like behavior could be mediated by activation of amygdala neurons. In this study, we determined the neural activities in the central nucleus of amygdala (CeA) as well as the PVN during yawning response accompanied by conditioned fear in freely moving rats using c-Fos immunohistochemistry. In addition, we examined whether activation of CeA neurons projecting to the PVN is involved in yawning responses using retrograde tracing method. Three to five days before experiment, retrograde tracer, Fluoro-Gold (0.2 μ l, FG), was injected into the PVN with pressure via a Hamilton syringe. Rats were exposed to emotional stress induced by fear conditioning paradigm, in which rats were placed in a conditioning box with electrical foot-shock (0.7 mA, 3 sec, 5 times) once a day before the experiment. We counted the number of yawning and anxiety- or fear-like behavior by direct observation for 60 min in the open-field box. Emotional stress significantly increased the number of yawning as well as fear- or anxiety-like behavior. In addition, emotional stress significantly activated CeA neurons as well as OT neurons and CRF neurons in the PVN, and also increased the number of both FG and c-Fos positive cells in the CeA. These findings suggest that yawning response accompanied by conditioned fear is involved in activation of CeA neurons projecting to the PVN.

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Keyword(s): FEAR CONDITIONING

YAWNING

RETROGRADE

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