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Selective activation of dorsal raphe nucleus-projecting neurons in the ventral medial prefrontal cortex by controllable stress.

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Source

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Abstract

Exposure to uncontrollable stressors produces a variety of behavioral consequences (e.g. exaggerated fear, reduced social exploration) that do not occur if the stressor is controllable. In addition, an initial experience with a controllable stressor can block the behavioral and neural responses to a later uncontrollable stressor. The serotonergic (5-HT) dorsal raphe nucleus (DRN) has come to be viewed as a critical structure in mediating the behavioral effects of uncontrollable stress. Recent work suggests that the buffering effects of behavioral control on the DRN-dependent behavioral outcomes of uncontrollable stress require ventral medial prefrontal cortex (mPFCv) activation at the time of behavioral control. The present studies were conducted to directly determine whether or not controllable stress selectively activates DRN-projecting neurons within the mPFCv. To examine this possibility in the rat, we combined retrograde tracing (fluorogold iontophoresed into the DRN) with Fos immunohistochemistry, a marker for neural activation. Exposure to controllable, relative to uncontrollable, stress increased Fos expression in fluorogold-labeled neurons in the prelimbic region (PL) of the mPFCv. Furthermore, in a separate experiment, a prior experience with controllable stress led to potentiation of Fos expression in retrogradely labeled PL neurons in response to an uncontrollable stressor 1 week later. These results suggest that the PL selectively responds to behavioral control and utilizes such information to regulate the brainstem response to ongoing and subsequent stressors.

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