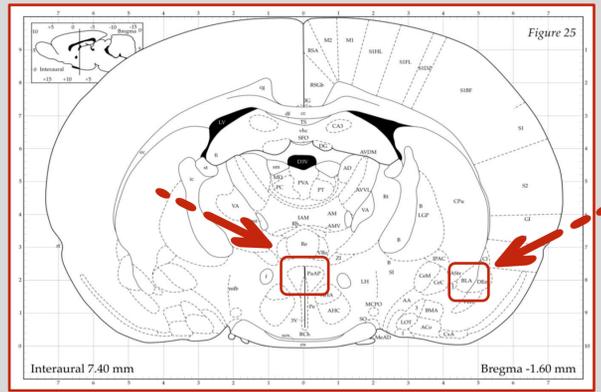




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Abstract

The effects of a traumatic event can be long-lasting, resulting in behavioral changes, cognitive impairment, perceptual issues, etc. Post traumatic stress disorder (PTSD) results in deficits in the neurobiological pathways that play a prominent role in fear and/or anxiety responses. One potential modulator of the neurobiological deficits of PTSD can be Mitogen Activated Protein Kinase (MAPK). Past studies speculate MAPK pathways are involved in the progression of PTSD. This study focuses on the presence of MAPK in the basolateral amygdala (BLA) and paraventricular nucleus of the hypothalamus (PVN) of rats exposed to fox odor, a natural predator type stress that induces PTSD-like responses. Results demonstrate no elevation of MAPK in the BLA of the animals exposed to stress, but a significant elevation in the PVN. These findings suggest the MAPK system may help modulate trauma-like responses through the PVN, which aids in identifying which pathways to regulate while treating PTSD.

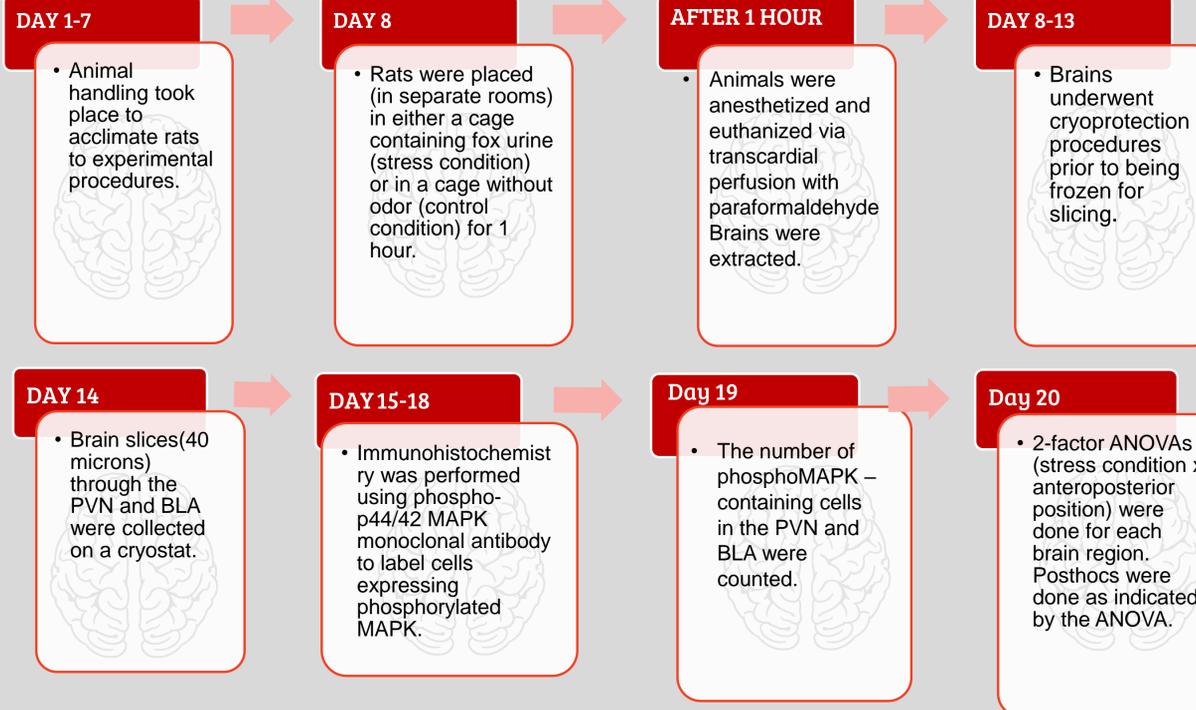


The above photo was obtained from the Brain Atlas. Arrows are pointing towards the PVN and BLA.

Introduction

- According to U.S Department of Veteran Affairs, about 6 of every 10 men (60%) and 5 of every 10 women (50%) will experience a traumatic event in their life, including, but not limited to, sexual assault, domestic abuse, and loss of a loved one.
- 6 out of every 100 people will develop Post-Traumatic Stress Disorder (PTSD) at some point in their lives.
- One prevalent symptom of PTSD is a deficit in emotional memory, which plays a key role in fear extinction and conditioning (Marie-France et al., 2014).
- Past studies have provided evidence for the role of Mitogen Activated Protein Kinase (MAPK) in fear extinction deficits.
- The amygdala has been directly associated with fear and anxiety (Davis, Michael, 1992).
- The PVN of the hypothalamus is another neurobiological region that is associated with fear and anxiety. The PVN has been signified as containing an immense amount of neuron types that respond to stress (Zhiying et al., 2019).
- MAPK pathway has been shown to be involved in the regulation of anxiety-like behavior in female rats, specifically in the PVN (Jureck et al., 2012).
- RESEARCH AIM:** This study aims to further research the role of MAPK in the BLA and PVN of rats that undergo fox odor exposure, a method that has been shown to act as an unconditioned fear stimulus (Wallace et al., 2000).
- Predator odor initiates the cascade of neurobiological responses similar to a traumatic event and MAPK in the PVN and BLA could potentially play a role.

Methodology



NOTE: Individual completing cell counting was blind to experimental conditions.

PICTURED BELOW: Cell bodies and their processes were stained black if positive for activated (MAPK). The cell bodies were counted within each slice (anterior, mid, and posterior) and each hemisphere (left and right).



Conclusion

- Predator odor elicited a significant increase in MAPK expression within the PVN.
- The predator odor resulted in a significantly higher elevation of MAPK within the anterior region of the PVN. No significant elevation was found within the mid and posterior region of the PVN.
- BLA showed no significant activation of MAPK.
- Although the MAPK pathway showed no significant activation within the BLA, the BLA is known to play a prominent role in the neurobiological response of the predator odor, as evidenced by numerous behavioral studies.
- It may be that a different intracellular pathway is responsible for the neurobiological response of predator odor within the BLA (e.g., FOS).

IMPORTANT TAKEAWAY: This study provides evidence of the importance of MAPK in the PVN during trauma-like stress in a rodent model. MAPK in the PVN may be an important cell signaling step for the neurobiological sequelae of trauma exposure in stress-related disorders such as PTSD.

Future Directions

Further studies could characterize the phenotype of the specific PVN cells that express MAPK in response to predator odor exposure. For example, it would be of interest to determine if the MAPK-positive cells also contain corticotropin-releasing factor (CRF), since these cells activate the neuroendocrine branch of the stress response. It will also be of potential clinical significance to determine if putative novel treatment strategies for PTSD (such as cannabinoids) might alter stress-induced MAPK expression in the PVN and/or the previously shown predator stress-induced FOS expression in the BLA.

Acknowledgements

This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. DGE-1747503 awarded to AKL. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. This research was supported by the National Science Foundation HRD-1612530 awarded to the Wisc-AMP program at the University of Wisconsin-Madison. This research was supported also by the National Science Foundation HRD-1612530 and a Vilas Life Cycle Award to VPB. We thank the Molecular and Cellular Pharmacology Program at the University of Wisconsin-Madison. We thank the Science and Medicine Graduate Research Scholars Program at the University of Wisconsin-Madison. We thank Ken Sadeghian for their assistance with the experiments.

Results

Effects of Predator Odor Stress on MAPK in the PVN

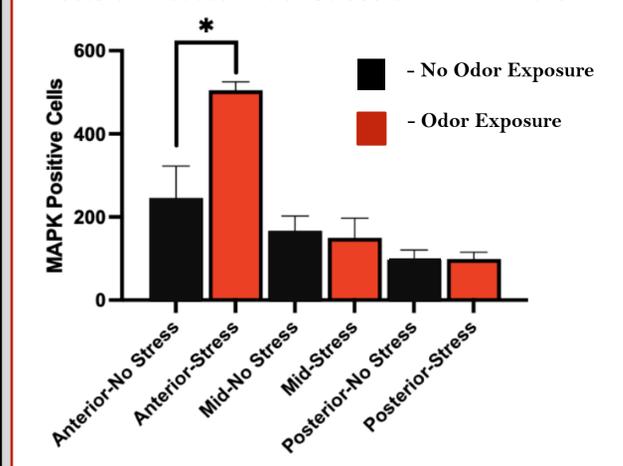


FIGURE 1. Above is the data for number of MAPK positive cells in the PVN (Anterior, Mid, and Posterior) of rats exposed and not exposed to odor.

Effects of Predator Odor Stress on MAPK in the BLA

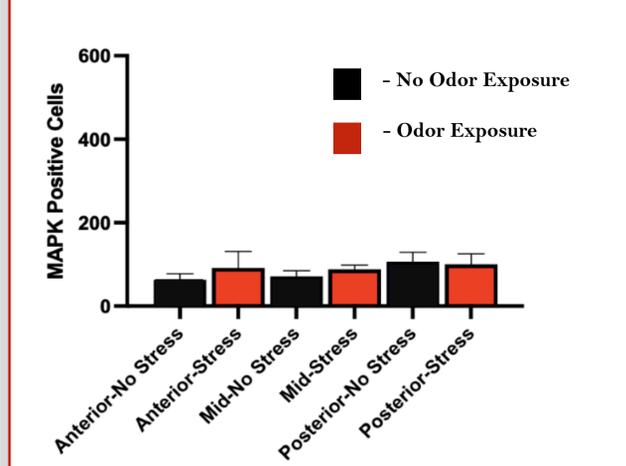


FIGURE 2. Above is the data for number of MAPK positive cells in the BLA (Anterior, Mid, and Posterior) of rats exposed and not exposed to odor.