

Neuroanatomy of Stress: Unraveling the Neural Circuits in Stress & Anxiety Disorders

Professor Dr Elizabeth O. Johnson

Department of Anatomy, Laboratory for Education & Research in Neurosciences (LERNs), National & Kapodistrian University of Athens, School of Medicine, Athens, Greece

Adjunct Professor, School of Medicine European University Cyprus

Stress and anxiety disorders demonstrate a lifetime prevalence of close to 30%, making them among the most prevalent mental illnesses of modern society. The high prevalence and negative effects associated with these disorders, underscores the need to delineate the underlying neural mechanisms to facilitate targeted treatment modalities. While the literature on stress and anxiety disorders is relatively extensive, it has been only the last few years that efforts have focused on the underlying neural circuitry. This review aims to identify the primary features of the neuromatrix of the stress circuit in the healthy brain, as well in stress and anxiety disorders. The primary characteristics of the major stress and anxiety disorders, including panic disorder, specific phobia, social anxiety disorder, post-traumatic stress disorder and generalized anxiety disorder, distinguish them along the fear – anxiety continuum, suggesting that their neural circuits may differ. Three primary anatomo-functional nodes appear to comprise the stress and anxiety neural circuitry. These include a limbic identification node, a cortical evaluation node and a cortical modulation node. The identification limbic node consists primarily of the amygdala and insula and serves to register stimuli and initiate the physiologic and behavioral responses, while the interpretation-evaluation node, which consists of the medial prefrontal cortex and anterior cingulate gyrus, functions to evaluate emotion and gate access of stress information to consciousness.

The hippocampus, the primary component of the modulation-regulation node, acts to modulate other cognitive regions and regulate emotion in a context appropriate manner. The over-riding executive region, which exerts deliberate regulation of emotion, appears to be the lateral pre-frontal cortex. Each of these key nodes in the stress and anxiety circuitry has a key player, which comprise an emotional triad and consist of the amygdala, medial prefrontal cortex and ventral hippocampus. Growing wealth of evidence suggests that the function of these key nodes differs in the primary stress and anxiety disorders. Fear disorders, including panic disorder and specific phobia show hyperactivity of the core limbic node, while anxiety disorders, such as post-traumatic stress disorder and generalized anxiety disorder show deficient interpretation and modulation nodes. Not only is the brain neuromatrix involved in the stress circuitry complex, but the evidence supports that chronic stress can affect and shift the structure and function of the neural regions involved.