

# NEUROPHYSIOLOGY 2021: Changes in the GABAergic signalling in the prefrontal cortex of mice model of posttraumatic stress disorder- Immanuel Kant Baltic Federal University/School of Life Sciences, Russia

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## Introduction:

Post traumatic stress disorder (PTSD) is a chronic mental state that possibly emerges after life or body integrity threatening events. On the neuronal level, the deterioration of hippocampus, medial prefrontal and medial temporal structures, amygdaloid complex and anterior cingulate cortices have been reported (Brewin 2001, Elbert & Schauer, Yamasue, Corbo, Kolassa & Elbert 2007, Kasai, Eckhart. Regions of the brain involved in episodic memory and emotional processing, such as parietal and lateral prefrontal cortices and posterior midline structures, have been emphasized as damaged, in studies concerning PTSD performed by functional magnetic resonance Imaging.

Certain overlap between structures involved in PTSD and craving, a major component determining relapses in alcohol abuse is obvious: the orbitofrontal cortex, dorsal anterior cingulated cortex and amygdala are pointed out to play a distinct role in craving (Koob & Le Moal 2008). The involvement of the anterior cingulate cortices and nucleus accumbens in alcohol craving has been demonstrated by positron emission tomography and functional magnetic resonance imaging.

**Objectives:** Neurological Institute (MNI) 138 standard spaces, by means of affine transformations based on 12 degrees of freedom (i.e. three translations, three rotations, three scalings and three skews). After subcortical registration, a subcortical mask was applied, to locate the different subcortical structures, followed by segmentation based on shape models and voxel intensities. The absolute volumes of subcortical structures were calculated, taking into account the transformations made in the first stage (Smith et al. 2004, de Jong et al. 2008).

Finally, a boundary correction was used to determine whether boundary voxels belonged or not to the structure examined. In this study a Z-value of 3 was used, corresponding to a 99.998% certainty that the voxels belonged to the mentioned subcortical structure.

After registration and segmentation of all 158 MR scans, all segmented subcortical regions were visually checked for errors in registration and segmentation. Brain tissue volume was estimated with SIENAX, part of FSL (Smith et al. 2004). SIENAX starts by extracting brain and skull images from the single whole-head input data (de Jong et al. 2008). Tissue-type segmentation with partial volume estimation has been carried out (Zhang et al. 2001) in order to calculate the total volume

of the brain tissue (including separate estimates of volumes of the grey and white matter). For this study we used the absolute volumes generated by the algorithm.

**Results:** Chronic stress induces structural and hormonal changes in the various brain structures: caudate nucleus, putamen, hippocampus, amygdala, prefrontal cortex in participants with post-traumatic stress disorder. Based on the results of recent neuroimaging studies on post-traumatic stress disorder, hippocampus, amygdala, and prefrontal cortex play a key role in triggering the typical symptoms of PTSD. Cortisol, as the primary stress hormone, together with dehydroepiandrosterone, tries to return the body to its original state of homeostasis, but its disturbed concentration levels can modify brain structures volumes. The scanning was performed using a 3.0 T whole-body scanner (Philips Medical Systems, Best, The Netherlands). Saliva was taken from all examined participants, for the determination of cortisol concentration and its effect on volume changes of the examined brain structures. The strongest headache that might occur during the day was marked on the pain rating scale (0–10). Hamilton depression rating scale was used for rating the depression level. Studies are moving toward the recognition of different biomarkers that would indicate the presence of clinically significant symptoms and a predisposition or increased risk of developing post-traumatic stress disorder, which can be made by increasing the number of studies, number of participants, and number of different methodologies.

**Conclusions:** IGD presents some characteristics that are not extensive to online GD. These specificities have potential clinical implications and they need to be further studied