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Stress- and Age-related Differential Activation of the Amygdala during Auditory Fear Conditioning in Male Rats

Adolescence is characterized by hormonal, physical, and psychological changes. In many species, this period is marked by major developmental changes of stress-responsive areas of the brain and the hypothalamus-pituitary-adrenal axis (HPA axis), the neuroendocrine axis that mediates hormonal stress response. These changes are highlighted as major contributors in the increased susceptibility of adolescents to develop psychopathologies, such as anxiety and PTSD. Studies have also suggested that, in humans, stress experienced during early adolescence (defined as the time period between the end of childhood and start of puberty) also contributes to higher prevalence of stress-related psychopathologies. In humans and rodents, fear conditioning is considered the central pathogenic mechanism involved in these disorders.

Previous studies have found a difference in the way juvenile (30 days of age) and adult (70 days of age) male rats learn the association between a neutral tone (CS) and an aversive shock (US) during an auditory fear conditioning task, which targets the acquisition, maintenance, and extinction of fear memories. Specifically, in the absence of a psychogenic stressor prior to conditioning, juvenile male rats show greater fear conditioning than their adult counterpart. Furthermore, juveniles exposed to a pre-conditioning stressor exhibit greater fear conditioning than non-stressed juveniles, as well as non-stressed and stressed adult rats.

The aim of this experiment is to study the neural substrates that may mediate this stress- and age-related difference in fear response. Studies have highlighted the amygdala as playing a crucial role in the development and expression of conditioned fear. In this study we therefore investigate the impact of age and stress on neural activation, as measured by FOS immunostaining, in parts of circuitry involved in auditory fear learning: the basal lateral (BL), lateral (LA), and central nucleus (CeA) regions of the amygdala. We are currently starting to gather cell activation data. We hypothesize to observe the highest FOS activation in tissue belonging to juveniles exposed to stress prior conditioning.