Examining Age and Gender Dependent Effects of Chronic Social Stress on the Architecture of Layer II/III and Layer V Pyramidal Neurons of the Prefrontal Cortex

I study the biological basis of chronic stress on the prefrontal cortex (PFC). My aim is to examine age and sex dependent effects of chronic social stress on the morphology of layer II/III and layer V pyramidal neurons of the PFC. The PFC is responsible for high level cognition, such as planning. The PFC, however, is vulnerable to stress (Arnsten 2009). Studies in rat models have demonstrated stress-induced architectural changes in the PFC (Radley et al. 2004) and deficits in PFC-dependent cognitive tasks (Cerqueira et al. 2007). Furthermore, prior studies suggest the stress response to vary between sexes; for example, female humans have higher sensitivity to stress and display a higher prevalence of psychiatric disorders. (Curtis et al. 2005, Bangasser 2010). In my study, social stress is induced via the resident-intruder paradigm. I hypothesized there to be significant age and sex dependent differences in morphology of layer II/III and layer V PFC pyramidal neurons as a result of social stress. There are eight experimental groups: adult and adolescent male and female sprague dawley rats are exposed to either social stress or control manipulation for five consecutive days. Brain tissue is then processed and visualized via golgi staining. Cellular measurements are taken via Neurolucida. I measure changes in apical and basilar dendritic length and branching. Results indicated significant stress-induced remodeling. In layer V, stress increased apical and basilar length and branching in adult males, but reduced it in other groups. In layer II/III, stress again increased apical dendritic length in males, but decreased basal branching and length. Stressed adolescent male and females displayed decreases in apical and basal branching but increases in basal length. Adult females showed decreases in basal branching and length. The data show extensive remodeling as a result of chronic social stress. Remodeling, however, appears to vary depending on age and sex. Interestingly, there appears to be variation between layers as well. Growth in layer V in adult males was unexpected and we theorize this to be a stress-adaptive mechanism. This research aids in illuminating the neural basis of stress pathology, which contribute to a better understanding of the stress response circuits. This can aid in the development and selection of appropriate treatments for stress related disorders, such as anxiety or depression.
Works Cited


