

Title:

What is the link between the reward system and the immune system?

Nature vs. nurture in brain organization: insights from visual loss and blindfolding protocols in the developing vs. adult brain plasticity and new scalable clinical interventions

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Neuroinflammation and chronic stress contribute significantly to brain degeneration in normal aging and in degenerative diseases, affecting brain areas that compute spatial and verbal cognition and memory. Studies show that clinical psychological interventions offer promise in mitigating inflammation and chronic stress and thus potentially slowing degenerative brain pathologies. Alongside, studies from our lab showed that visual deprivation can lead to superior memory in early blindness (Amedi et al Nature Neurosci 2003, 2004), and that various training protocols in the adult brain that include visual deprivation holds potential to induce neuroplasticity via strengthening of weak existing brain connectivity (e.g. Aggious-Vella et al. Current Biol. 2023). In the talk I will present various recent studies evaluated the effect of a comprehensive digital psycho-cognitive multisensory training on the association between brain plasticity and the immune system in individuals with subjective cognitive decline (SCD) and on individuals with high levels of anxiety and depression. Participants followed a 2-6 weeks of daily half-hour digital training protocol. The protocol utilizes egocentric and allocentric Hebb-Williams based maze solving strategies, audio-visual navigation cues, and gradual masking vision techniques alongside with various methods from clinical psychology to reduce stress and anxiety (e.g. attention training techniques and cognitive based therapy). Study endpoints encompass brain resting-state functional connectivity (rsFC), DTI and salivary and blood immunological biomarker levels. Following training, there were large scale changes in a set of inflammatory biomarkers that are correlated with changes in areas that are tightly linked to brain degeneration with age and with depression and anxiety. These findings suggest that our combined psycho-cognitive intervention and multisensory approach that include a component of sensory visual deprivation induces a synergetic effect on both brain function and neuroinflammation. As alternations in the middle temporal cortex (including the hippocampus), Default Mode Network and the Salience network, as well as increased levels of various pro-inflammatory cytokines, are associated with the aging process and Alzheimer's disease, these findings suggest a promising impact on the aging brain in clinical brain degeneration and in mental health diseases. I will also discuss how such studies challenge the critical period theory and I will suggest a major revision to this theory mainly using studies with people with no visual experience (especially in the domain of reading).