University of Zurich[UZH]

Department of Economics – Neuroeconomics Seminar

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Neural control of human defensive reactions to social threat

The ability to control automatic emotional actions constitutes a critical component of emotion regulation during socially threatening situations. For instance, under acute social threat, goal directed decision-making depends largely on the capacity to override automatic defensive actions such as freezing reactions or fight-or-flight actions. Distinct parts of the frontal cortex are implicated in regulating these defensive reactions. I will present a number of experimental paradigms by which we assessed neural control over these defensive reactions in humans, in which we combined decision tasks with neural and autonomic measures. The first series of studies indicates that down-regulation of amygdala activity by the anterior prefrontal cortex (aPFC) is involved when people need to override their automatic social approach-avoidance action tendencies. I will show that the functioning of this neural circuitry is sensitive to individual differences in social anxiety and aggression, and I will discuss recent manipulations of this neural circuitry by steroid hormone administration (i.e. testosterone) and brain stimulation (TMS). The second series of studies investigates the shift from parasympathetically-dominated freezing to sympathetically-driven fight-or-flight reactions in humans. Like freezing in many animals, human freezing is accompanied by bradycardia and associated amygdala projections to the midbrain (periaqueductal gray). The shift from freezing to action involves tachycardia and associated recruitment of the perigenual part of the anterior cingulate cortex (pgACC) as well as pgACC-amygdala connections. I will end with evidence from longitudinal research suggesting that alterations in these primary defensive reactions in infancy are predictive of the development of affective symptoms in late adolescence. Together, these series of studies show that distinct frontal regions are implicated in controlling defensive reactions, and that the ability to flexibly shift between different defensive response modes is essential for adequate threat coping. It is this ability that may fail in social emotional disorders such as social anxiety and aggression-related disorders.