The neurobiology underlying drug addiction: lessons from multimodality imaging and neuropsychological studies in humans

Drug addiction is a chronically relapsing disorder characterized by compulsive drug use despite catastrophic personal consequences (e.g., loss of family, job) and even when the substance is no longer perceived as pleasurable. In this talk, Dr. Goldstein will present results of human neuroimaging studies, utilizing a multimodal approach (neuropsychology, functional magnetic resonance imaging, positron emission tomography, event-related potentials recordings), to explore the neurobiology underlying the core psychological impairments in drug addiction (impulsivity, drive/motivation, insight/awareness) as associated with its clinical symptomatology (intoxication, craving, bingeing, withdrawal). The focus of this talk is on understanding the role of the dopaminergic mesocorticolimbic circuit, and especially the prefrontal cortex, in higher-order executive dysfunction (e.g., disadvantageous decision-making such as trading a car for a couple of cocaine hits) in drug addicted individuals. The theoretical model that guides the presented research is called iRISA (Impaired Response Inhibition and Salience Attribution), postulating that abnormalities in the orbitofrontal cortex and anterior cingulate cortex, as related to dopaminergic dysfunction, contribute to the core clinical symptoms in drug addiction. Specifically, Dr. Goldstein’s multi-modality program of research is guided by the underlying working hypothesis that drug addicted individuals disproportionately attribute reward value to their drug of choice at the expense of other potentially but no-longer-rewarding stimuli, with a concomitant decrease in the ability to inhibit maladaptive drug use. In this talk Dr. Goldstein will also explore whether treatment (as usual) and 6-month abstinence enhance recovery in these brain-behavior compromises in treatment seeking cocaine addicted individuals. Promising novel fMRI studies, which combine pharmacological (i.e., oral methylphenidate, or Ritalin™) and salient cognitive tasks or functional connectivity during resting-state, will be discussed as examples for using neuroimaging in the empirical guidance for the development of effective neurorehabilitation strategies in cocaine addiction.