An integrative view of neuromodulation of cognitive control

Funding country: Netherlands
Project starting year: 2008
Project ending year: 2011
Area(s) of research: Consequences of drug use, Mechanism of drug use and effects

Objectives:
The proposed research project extends our understanding of DA as underlying key neurotransmitter of healthy and impaired cognitive control; apart from providing important insights into the long-term effects of cocaine (a drug that took this year in Europe has become the second preferred recreational drug after cannabis).

Scientific discipline(s) involved: Psychology

Initial identified needs:
Frontal lobe circuits have a crucial role in the cognitive control of human thoughts and actions. These circuits are innervated by dopamine (DA), a neurotransmitter targeted by many drugs, such as cocaine. However, little is known about exactly how dopaminergic supply affects control functions. Here I propose a new Integrative Neuromodulation of Cognitive Control (INCC) model that distinguishes between two control circuits that are dominated by particular DA receptor types (D1 and D2): a DA/D1 system driving working memory and response execution (implying Premotor Cortex and Dorsolateral Prefrontal Cortex) and a DA/D2 system driving response inhibition, cognitive flexibility, conflict control and adaptive decision making (implying Ventrolateral Prefrontal Cortex, the Anterior Cingulate and Orbitofrontal Cortex). The INCC model is the first of its kind to incorporate this distinction. It allows for a number of interesting predictions that will be tested by comparing the impact of the drug ecopipam, a selective antagonist of DA/D1 receptors, and of the recreational use of cocaine, which selectively impairs DA/D2 receptors. Ecopipam effect will be investigated in within-subjects double-blind studies and cocaine effects will be tested by comparing recreational users with matched healthy non-users—all strictly controlled for polydrug use and confounds. Theoretically motivated tasks will be used to assess working memory efficiency, cognitive flexibility, and response inhibition, conflict monitoring and control, and adaptive decision making in behavioural reaction time tasks, electrophysiological experiments, and an functional magnetic resonance imaging (fMRI) study.

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Summary references:

Website:

Published reference(s):