

Dual Diagnosis

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Behavioural and electrophysiological study of nucleus accumbens

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Methylphenidate (MPD) considered as the gold standard in the treatment of attention deficit hyperactivity disorder (ADHD), one of the most common childhood disorders. MPD is also finding their way into the hands of healthy adolescent as brain augmentation to improve cognitive performance and for recreation. The possible long term effects of MPD exposure in adolescence are considered controversial. The objective of this study is to investigate the acute and chronic dose response characteristics of MPD on animal behavior concomitant with nucleus accumbens (NAc) neuronal activity recorded in freely behaving adolescent rats. The experiment lasted for 10-16 consecutive days after the recovery from implanting 4 permanent semi microelectrodes in the NAc or its destruction. Four groups of intact animals and eight groups with electrical or chemical NAc lesion were used: saline (control), 0.6, 2.5 and 10 mg/kg MPD groups. Acute MPD was found to elicit a dose response increase in animals' locomotor activity. Re-challenge with MPD at experimental day 10 (ED10) compared to the effect of MPD at ED1 showed no significant differences. When the animals were divided into groups based on their individual responses to chronic MPD exposure, some animals expressed behavioral tolerance and some expressed behavioral sensitization. NAc destruction prevents the chronic effect of MPD to elicit behavioral sensitization or tolerance. Behavioral sensitization and tolerance is an experimental indicator suggesting that a drug has the potential to elicit dependent. Electro-physiologically, a dose response characteristic for acute and chronic MPD exposure was observed. With increasing MPD doses, more NAc units responded by changing their firing rate. Moreover, the neuronal responses to chronic MPD recorded from animals expressing behavioral tolerance were significantly different compared to the neuronal population responses recorded from animals expressing behavioral sensitization. The majority of the NAc units recorded from animals expressing behavioral tolerance responded to MPD predominately by decreasing their firing rates, whereas NAc units recorded from the behaviorally sensitized animals mainly showed an increase in their firing rates.

Biography

Nachum Dafny has received his MS and PhD degrees from Hadassah Medical School in Jerusalem in 1965 and 1969, respectively followed by Post-docs at Caltech, UCLA, and Columbia. He is currently a Professor of Neurobiology at the University of Texas Medical School at Houston.

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