

# Improved Rat Psychomotor Vigilance Test with Fast Response Times

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## ABSTRACT

In order to investigate physiological mechanisms in the control of sleep, we require an animal model of the psychomotor vigilance test (PVT) with fast response times. For rats, whisker stimulation produces a rapid and robust evoked response. A fast lick response can be obtained using water as a reward. Our prior experiments used deprivation-based approaches to maximize operant conditioned responses. Evidence suggests that deprivation states can have physiological and neurobehavioral effects and therefore, the present study was designed to identify alternative methods to maintain operant responding. Licking behavior was used to obtain a cognitive operant response and test reaction times as short as 100ms. A high density 64 channel electrode array was chronically implanted to measure whisker barrel evoked response potentials (ERPs) during whisker stimulation. The array created high spatial and temporal resolution electrical maps of the cortical surface, allowing visualization of the cortical column responses. We conditioned rats for immobilization and head restraint, then trained them to lick in response to whisker twitching. After two months of immobilization training, animals remained calm for up to an hour while restrained. A sucrose solution reinforced correct responses when the animal licked to the reward whisker. After approximately 20

sessions of lick training, the animals produced greater than 80% correct responses to the twitch stimulus without the use of deprivation. The PVT has been shown to be a sensitive measure to sleep loss, as well as changes in circadian systems. This conditioned learning paradigm will aid in the study of localized sleep-like functional states that may occur in the cortical columns.