Abstract View

TOWARD AN ANIMAL MODEL FOR RESEARCH ON THE CIRCADIAN MODULATION OF COGNITION: INTERACTIONS BETWEEN SUSTAINED ATTENTION PERFORMANCE AND CIRCADIAN ENTRAINMENT

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Circadian shifts and shift work detrimentally affect cognitive abilities, but little is known about the neuronal mechanisms mediating these effects. This study examined the hypothesis that attentional abilities are negatively impacted by circadian phase shifts of the light cycle. We also determined the influence of the time of day of attentional performance on circadian entrainment under stable conditions. Rats were trained to perform an operant sustained attention task requiring the detection of visual signals as opposed to non-signal events. Daily training occurred 4 h after lights on (ZT4) prior to a phase shift of 6 h when the session occurred 2 h before lights off (ZT10). The effects of phase shift on performance under challenging conditions was tested by presenting a visual distractor on days 2-6 of the phase shift (14.3 + 3.3 days for recovery). During phase shifts, animals omitted more trials. Presentation of the distractor during phase shifts triggered an increase in the number of false alarms (claims for signals in non-signal trials). The length of time to recover from the phase shift correlated with measures of the animals' overall attentional performance. During training at ZT4, all animals produced diurnal activity patterns. Even after the phase shift, when attentional performance started at ZT10, 33% of the animals were strongly diurnal and 17% modestly diurnal. Diurnality positively correlated with the increase in the number of false alarms during distractor exposure without a phase shift, and with distractor-induced impairment in the animals' performance during a phase shift. These data suggest that attention-demanding cognitive tasks can cause a reorganization of entrained daily activity, and phase shifts in the light-dark cycle impair the animals' attentional abilities. Ongoing experiments test hypotheses about the role of basal forebrain cholinergic projections in the mediation of the detrimental cognitive effects of phase shifts.
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