



# Research Week 2021

## Circadian rhythmicity of mood reactivity to a physical-cognitive stressor

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### Abstract

Internal circadian rhythms modulate mood, with positive affect (PA) being highest in the early evening and lowest in the circadian night/early morning. Mood is also commonly worsened by cognitive and psychosocial stressors. To determine if mood responses to stress interact with the circadian system, we examined mood before and immediately after mixed physical-cognitive stressors presented across the entire circadian cycle. After 1-3 weeks of regular 8-hour sleep schedules at home, six medication-free participants (aged:  $41 \pm 8$  y [mean  $\pm$  SD]; 4 female) underwent a 7-day in-laboratory protocol free of time cues and in dim-light. The protocol consisted of one acclimation day, a baseline assessment, then six identical recurring 18-hour behavioral cycles (12-hour wake/6-hour sleep opportunity per cycle). All behaviors—including psychological testing—were therefore evenly distributed across the circadian cycle. Mood responses to a Paced Auditory Serial Addition Test (PASAT) co-administered with a Socially-Evaluative Cold-Pressor Test (SECPT) 8-hours 20-minutes from scheduled wake were assessed via abbreviated Profile of Mood States (POMS) and Positive/Negative Affect Schedule (PANAS). Circadian phase was calculated relative to salivary dim-light melatonin onset ( $>3$  pg/mL threshold) and individual z-scores for changes in POMS/PANAS scores were averaged in four 90° circadian bins and analyzed using mixed-effect models. Across the whole circadian cycle, total mood disturbance (TMD) and negative affect dropped in response to the PASAT-SECPT by an average ( $\pm$ SD) of  $1.71 \pm 1.34$  and  $0.023 \pm 0.53$  points respectively, while PA increased by  $1.44 \pm 2.33$  points (significant for TMD and PA;  $p < 0.001$ ). Thus, mixed physical-cognitive stressors improved mood overall. The greatest change in PA across the combined PASAT-SECPT occurred at 90° ( $\sim$ 4:30AM;  $+0.65$  z-score units;  $p = 0.043$ ), during the circadian nadir of mood in the early biological morning. These findings may have implications for psychological responses to stress in those awake during the biological night (e.g., shift-workers). To ensure statistical robustness, this protocol will need to be repeated in a larger population.