

Study to assess impact of sleep on cognitive and emotional well-being

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Sleep subjects will use a wireless brain monitor with three sensors incorporated into a headband that will interface with a smartphone.

Over the past decade, scientists have learned that sleep is one of the best memory aids available, but Mark Gluck wants to take that research further. The Rutgers professor, an expert in cognitive and computational neuroscience, is seeking to answer important questions about the complex interactions between natural fluctuations in sleep and their influence on cognitive and emotional wellbeing.

Thanks to a \$552,307 three-year grant from the National Science Foundation (NSF), Gluck, will be able to conduct the investigation that he hopes will find those answers. The grant from the NSF's new

interdisciplinary program, "Smart Health and Wellbeing" program, will fund Gluck's [sleep](#) assessment study at Rutgers-Newark, where Gluck is director of the Rutgers [Memory Disorders](#) Project, and publisher of the public health newsletter, [Memory Loss and the Brain](#). According to Gluck, sleep affects our daily lives by influencing two central processes: memory-consolidation and [emotional regulation](#). His research will focus on two key questions:

- What is the cumulative effect, over many days, of fluctuations in [sleep patterns](#) on cognitive and emotional well-being?
- What are the effects of sleep on the gradual consolidation of memory in activities which require ongoing practice for days or weeks to master?

Until now, scientific sleep studies have been hampered by the need to conduct them in lab settings, with subjects wired to brain-monitoring machinery. The setting is not conducive to natural sleep, and the subjects usually can spend only a couple of days away from their normal activities, in the lab. Such settings are costly, and have limited the quantity and diversity of individuals who participate in sleep and [memory studies](#). In addition, until now, most studies have failed to consider a natural baseline for an individual, when performing sleep-based research, which may account for variability in many studies.

Gluck, principal investigator for the project, will be working with a consultant, Matt Walker of University of California-Berkeley, one of the most prominent sleep-cognition researchers; a Rutgers graduate student, Sue Peters, whose background in engineering and mobile computing provides essential technical experience; and Itamar Lerner, a new postdoctoral fellow in Gluck's lab from Hebrew University.

The research will use two "smart-health" technologies that are both

longer-term and more natural for the subjects: Long-term Mobile Sleep and Activity Monitoring, and Mobile Individualized Cognitive Assessment.

The Long-term Mobile Sleep and Activity Monitoring will allow subjects to be assessed for several weeks in their own homes, using a specially designed mobile system, adapted from commercially available technologies, for sleep and activity monitoring. This project includes several devices. The first is a Zeo™ wireless brain monitor, with three sensors incorporated into a headband that will interface with a smartphone as it records muscle tone, eye movement, and electrical information from the brain, which are translated into relevant information such as Rapid Eye Movement Sleep and non-REM sleep. The subject will also wear an "actigraph bracelet" with a built-in movement detector and enough memory for several weeks of data storage. The combination of the technologies will allow for a more accurate assessment of the individual's wake time, sleep time and sleep structure. Finally, the monitoring system includes a mobile device management system, a secure cloud-based software server which tracks the various devices for usage, stores the data for daily access by the researchers, and allows for updating of software and content as needed on devices. This system will enable the subjects to use their own smartphone devices for the transfer of sleep monitoring data.

The assessment technology will deliver twice-daily short cognitive tests and other self-assessments in participants' homes, using wireless tablets provided to each subject. Gluck and his team will measure baseline levels of cognitive performance as well as performance changes through the twice-daily testing, while ensuring consistency of the task presentation and maintaining integrity of the data collected. The researchers will transmit specially designed cognitive tests, and the subjects also will use the devices to keep a digital journal. All results and journal entries will be transmitted wirelessly and securely through the

internet, and stored with the corresponding sleep data.

Gluck believes the results from the project "will move sleep research forward, addressing many critical heretofore unanswered scientific questions about brain, behavior and cognitive and emotional wellness.

Provided by Rutgers University

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