Preventing Sleep Deprivation

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Sleep deprivation is a *fact* of modern combat. Current operations depend upon the warfighter's ability to function for extended periods of time without adequate sleep. For example, a pilot may be required to fly continuously for 30 hours or more in order to reach the target and safely return home. For Special Forces, a search and rescue mission may necessitate 48-72 hours of sustained activity, whereas advancing ground troops might engage in weeks of combat operations with only 3 hours of sleep per night. Command and control personnel frequently share similar, and sometimes even more extreme, requirements for sustained cognitive performance despite minimal sleep. The widespread operational demand for optimal performance in sleep-depriving conditions demonstrates the necessity for development of methods to safely combat sleep deprivation and to prevent the associated degradation of performance.

The goal of the "Preventing Sleep Deprivation Program" is to define and implement approaches to prevent the harmful effects of sleep deprivation, and to provide methods for recovery of function with particular emphasis on cognitive and psychomotor impairments. Examples of multidisciplinary research currently supported by this program include the following:

A research team centered at Wake Forest University is verifying and extending preliminary data demonstrating that the novel class of medicines known as "Ampakines" is protective against cognitive deficits associated with sleep deprivation. Ampakines already have been proven safe in humans, and are currently in clinical trials for the restoration of mental function in patients with dementia. It is envisioned that Ampakines may provide an alternative to current stimulant medications used by pilots.

Researchers at Salk Institute and Mars, Inc will completely characterize the neuro-protective and neuro-regenerative effects of a natural anti-oxidant nutrient found in cocoa. As part of this effort, Columbia University is pioneering imaging techniques that will allow the non-invasive measurement of neurogenesis based upon perfusion characteristics of the tissue. This method allows for imaging without introduction of chemicals like contrast agents that may alter normal physiologic function.

A team centered at Columbia, utilizing functional brain imaging, has determined that certain neural pathways, used for accomplishing specific mental tasks, are much more resilient to sleep deprivation than other pathways, and the individuals who normally use these pathways perform much better after sleeplessness. The goal of this phase of the proposal is to determine whether individuals can learn to use these resilient pathways through training accompanied by transcranial magnetic stimulation.

Finally, groups at Wisconsin, Northwestern and UCLA are studying diverse species or strains of species which either require very little sleep, or which have evolved novel solutions to enable periods of prolonged activity without sleep. For example, migratory birds sleep normally until the time of migration. Once embarking upon migration extreme physical activity is accomplished without sleep, and without noticeable ill effects. By discovering how "nature" has approached sleep deprivation, we will gain insight into safe approaches to assist our troops.

Please see the "Publications" tab for a list of publications and reports arising from the "Preventing Sleep Deprivation Program".

The approaches discovered in this program will greatly assist our soldiers to function more safely and effectively despite the prolonged wakefulness inherent in current operations.