Sleep deprivation can be used to investigate the physiology and pathology of human sleep. Previously, human sleep deprivation has been done manually by a sleep expert performing visual online interpretation of the electroencephalogram (EEG). When the subject enters the stage of sleep to deprive the sleep expert disturbs the sleep manually by touching the subject or by activating some kind of stimulation. This is a time consuming task and might cause large variations in the results.

In this study, a computerized system capable of performing automatic and selective sleep deprivation was developed and tested. The system consisted of a modified version of the well-approved Nightingale sleep analyzer and a custom made external alarm providing auditory stimulation to the subjects. To evaluate the efficacy of the system, removal of slow wave sleep (SWS) was selected. The sleep analyzer was used for online detection of the sleep stage, which subsequently activated the alarm. The system was tested on ten young healthy, male subjects. All subjects were sleeping for three consecutive nights in the laboratory, one adaptation night, one baseline night and one deprivation night.

The number of 30 seconds epochs spent in the non rapid eye movement sleep stages (NREM) 3 and 4 during the baseline and the deprivation night were compared. On average it was possible to remove 98% of the subject's NREM4 sleep stage and 42% of stage NREM3. Furthermore, micro-sleep patterns, i.e. the frequency representation of the EEG, was calculated by means of power spectrum analysis. A comparison of power in the delta band (0.5-3.5Hz) between the baseline night and the deprivation night showed that it was possible to remove 50% of the delta activity. This study introduces computerized method for performing automatic and standardized sleep deprivation of slow wave sleep. This method makes it possible to perform reproducible studies on sleep deprivation without the influence of human factors.