FINAL REPORT

AF-AFOSR-62-13

This grant period, extending from 1 January 1961 through 31 March 1962, has resulted in the execution of five studies and the development of an effective sleep laboratory. In accomplishing these tasks, 107 all-night sleep sessions and 40 two-hour afternoon sessions were recorded.

Personnel

The following personnel served on the project during the grant period:

Wilse B. Webb, Ph.D.	Principal Investigator
Robert Williams, M.D.	Co-Principal Investigator
Harman W. Agnew, Jr., M.A.	Research Associate
James C. Parker, M.S.	Consulting Engineer
James Hamby, B.A.	Laboratory Technician
Samuel Gresham, B.A.*	Research Assistant
Frank Freeman, B.A.*	Research Assistant

*Medical Students

Research Projects

I. Alcohol and caffeine: effect on inferred visual dreaming. S. C. Gresham, W. B. Webb, R. L. Williams. Science, Vol. 140, No. 3572, 14 June 1963, pp. 122601227.

EEG and EOG recordings were obtained on seven subjects for four experimentally uninterrupted nights and three experimental nights. On one experimental night subjects received 1 g/kg of body weight of 95% ethyl alcohol. On a second experimental night they received 0.005 g/kg of body weight of caffeine citrate. The alcohol resulted in a reduced total duration of EEG Stage 1 - rapid eye movement time and inferred visual dreaming. The caffeine produced no significant effect.

II. The effects of Stage IV deprivation. H. W. Agnew, Jr., W. B. Webb, R. L. Williams. (Accepted for publication by Electroencephalography and Clinical Neurophysiology.)

Five subjects were deprived of deep sleep (as defined by Stage 4 of the EEG) by sounding a tone sufficiently loud to "move" them from Stage 4 to a "lighter" stage of sleep (Stages 1 - 3) without awakening them. It was found that on a recovery night (uninterrupted sleep) immediately following such treatment

that their Stage 4 sleep significantly increased in amount when compared with their baseline Stage 4 amounts. These results suggest that there is a requirement for this stage of sleep.

III. The effects of rate of response requirements on tendency to go to sleep.

Forty subjects were given one-hour sessions in the afternoons in a darkened and sound-deadened room. Half the subjects were required to respond to a signal occurring on the average of every 30 secs.; the other half of the subjects responded to signals which occurred every 3 minutes on the average. No significant effects were noted on either tendency to sleep as measured by the EEG, or on missed signals.

IV. Effects of meprobamate on sleep patterns during all-night sleep.

Six subjects were run for seven nights each. On two nights meprobamate and placebo were administered. Initial analyses indicated that the amount of Stage 4 sleep was depressed. Additional subjects will be run to compare this effect.

V. The parameters of experimentally uninterrupted all-night sleep.

Studies I, II, and IV above were conducted so that their control nights could serve as experimental data for the description of sleep characteristics of normal subjects during "natural" (uninterrupted or experimentally unmodified) sleep. During these fifteen months, records of 44 such control nights were obtained and analyses begun of the following sleep parameters: percentage sleep stages (Stages 0, 1, 2, 3, 4, and Stage 1-REM), length of stages, number of sleep stage changes, sequence of stages, stages by one-thirds of the night.

Laboratory and Procedural Developments

Work on this grant has resulted in our being able to simultaneously record sleep measures for two subjects during a full night's sleep without artifact or record l s. Two sound, light and temperature controlled subject rooms and a monitoring room are used. The temperature in the subject rooms is controlled within 0.1° r of 72° F. Two EEG machines (a Grass Model IV and a Grass Model VI) are wired to the subject rooms. Eight-channel EEG recordings can be obtained, as well as two rapid eye movement (EOG) recordings. In addition, heart rate, body movements, respiration, and blood volume from finger and ear placements can be recorded from one subject room on a Polybraph V. Three measures of GSR and two measures of body temperature have been tested and discarded as unsatisfactory. A device which measures respiration rate and depth without attachments on the subject has been designed and is currently in operation. An audio system from the subject rooms is sufficiently sensitive to monitor all sleep-produced sounds in these rooms.

Satisfactory techniques have been developed for attaching electrodes in order to obtain stable recording over eight-hour periods.

Considerable effort has been devoted to developing scoring, training, and control procedures for EEG record scoring that result in a between scorer agreement of 90% or higher. (Records are scored for five sleep stages in one-minute epochs. The scoring procedures used result in at least 405 minutes out of 450 minutes of a 7 1/2-hour sleep period.)

Finally, an arousal task has been instrumented. This task consists of a signal panel which presents to the subject the numbers 1, 2, 3, and 4 in all possible orders of these signals. The subject is required to press four keys numbered 1, 2, 3, and 4 successivelv in the order presented on the signal panel. Successive sets of sequences can be presented as many times as required. The latencies of these responses are recorded on the EEG machine. This is a reliable task with limited learning changes. It requires a simple discrimination task with minimal perception, cognition, or motor skill components.

This research was supported by the Behavioral Sciences Division, AFOSR, SRLB
under [redacted]/G... AFOSR 62-13