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The Measurement of Change in Sleep during Depression and Remission*

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Summary. Sleep disturbances, which are a prominent symptom of depressive illness, were analyzed in endogenously depressed patients during depression and during full remission. These disturbances may be described at the level of sleep stages, at the level of the sleep profile, and at the level of consecutive sleep records.

The scoring of sleep stages in sleep records of depressive patients provides difficulties, because the temporal coherence of different electrophysiological descriptors of sleep is weakened during depression. The sleep profile of depressed patients is characterized by alterations in the normal sequence of sleep stages and frequent stage changes. The disturbances in the sleep profile are unstable in that they show marked day to day fluctuations. It could be shown in some patients that there is a correlation between parameters of the first REM sleep phase and urinary free cortisol excretion in corresponding nights.

Key words: Sleep – REM sleep – Depression – Cortisol.

Introduction

Since the disturbance of sleep is one of the most general complaints in depression, the longitudinal study of sleep may give some insight into the dynamics of the course of this illness.

The data which are presented here are part of an interdisciplinary investigation on various aspects of depression. The design of the study made it possible to test some current biorhythmical hypotheses on depression (Atkinson et al., 1975; Pflug, 1976). Circadian rhythms of different psychological and biological variables are measured during depression and full remission.

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Patients and Methods

Patients who take part in the study are diagnosed as endogenously depressed by two psychiatrists. Patients with any organic disease are rejected. During the study the selected patients are not given any medication for as long as possible under ethical and therapeutical considerations. The study is composed of measurements for 2—3 weeks during depression and for another 2 weeks, some months later, during full remission, again without any medication. Measurements are taken 7 times in 24 h at 0230, 0700, 1000, 1300, 1600, 1900, and 2200 h. The following variables are measured: mood by two self-rating scales (v. Zerssen et al., 1976), activity of arm and leg, rectal temperature, salivation, urine volume, urinary free cortisol (UFC) excretion and other constituents (electrolytes, adrenaline, and noradrenaline), and tapping speed. For nightly measurements (0230 h) the patients are awakened and are out of bed for about 10 min. A full description of the design and the results will appear later.

Polygraphic sleep recordings are taken every night during the study. Besides rectal temperature the following variables are measured continuously during sleep: electroencephalogram (EEG, C3-A2, C4-A1), horizontal and vertical electrooculogram (EOG) from both eyes, electromyogram (EMG) from the chin, and body movements by a transducer which is fixed to the bedsprings (actogram). Patients sleep in the room where they also live during the day. Sleep period is between 2300 h and 0700 h.

Up to now seven endogenously depressed patients have been examined, four of whom have also been examined during full remission.

Sleep disturbances associated with depression can be described at three different levels: (a) at the level of sleep stages, (b) at the level of the whole night sleep profile, and (c) at the level of the day to day variations in the sleep profile.

Disturbances at the Level of Sleep Stages

Sleep stages are based on the conception of high coherence of different electrophysiological signs during sleep. This holds for the most important descriptors of sleep physiology, namely EEG, EOG, and EMG, and is the basis for the classical sleep stage taxonomy (Rechtschaffen and Kales, 1968). Disturbances of these normal sleep stage patterns can be seen quite often during depression. Examples of such disturbances at the sleep stage level are the alpha delta sleep described by Hauri and Hawkins (1973) and the Stage 2 REM sleep which was described by Coble et al. (1976). Figure 1 gives an example of a Stage 2 REM sleep episode with two typical indicators of REM sleep: loss of muscle tone and rapid eye movements. In addition, we have sleep spindels in the EEG typical for Stage 2 sleep.

As can be seen from this example, sleep stages are by no means stable physiological entities. Rather they are the result of the temporal confluence of different physiological phenomena. This temporal coherence becomes weaker during depression. The weakening of the temporal coherence disappears during remission.

Disturbances at the Level of the Sleep Profile

The sleep profile is defined as the serial accumulation of visually or computer-scored sleep stages in time. Thus the sleep profile represents the pattern of an all-night sleep and is well defined for healthy subjects of different age groups

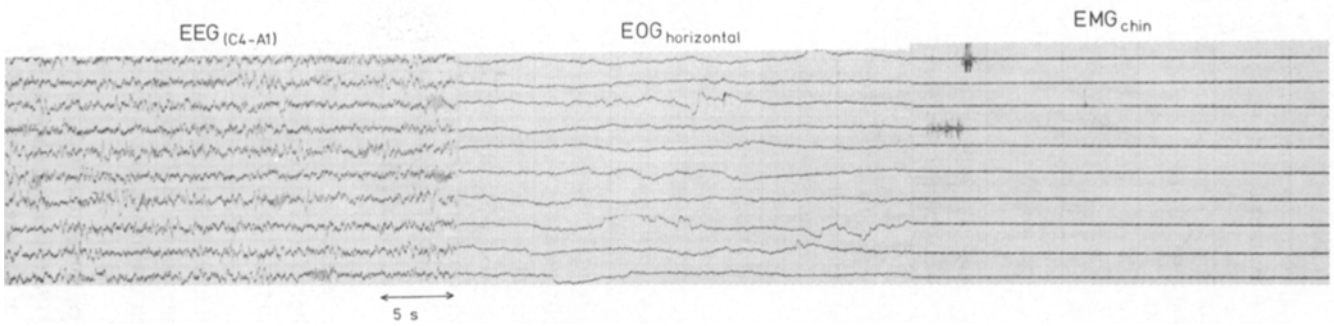

Fig. 1. Polygraphic monitoring of 5 min of Stage 2 REM sleep. There are sleep spindles in the EEG typical of Stage 2 sleep, while there are REMs in the EOG, and the chin EMG is completely abolished

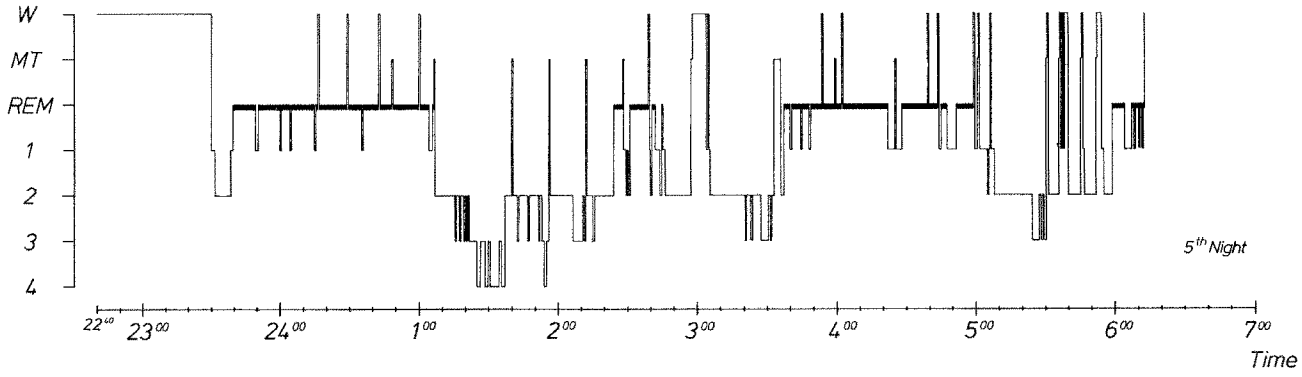

Fig. 2. Sleep profile during depression with a short REM latency, a long first REM sleep phase, a displacement of slow-wave sleep (S3+4), and many spontaneous awakenings. Before 0300 h there is forced awakening for testing the subject

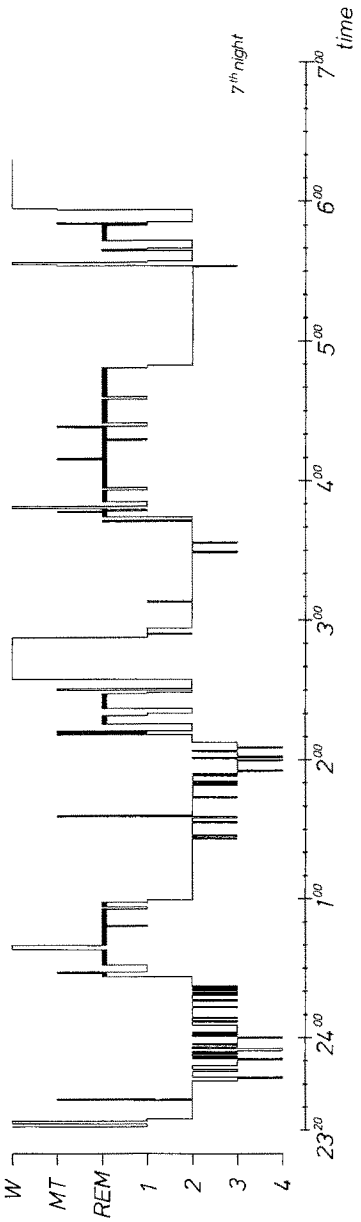

Fig. 3. Sleep profile during full remission with normal sleep stages latencies, fewer stage changes, and fewer spontaneous awakenings than during depression. Before 0300 h there is forced awakening for testing the subject

(Williams et al., 1974). During depression there is a pronounced redistribution of the normal sleep profile. This is due to unusual latencies for the different sleep stages, an increased number of stage changes, and altered sleep stage percentages (Mendelson et al., 1977).

Figures 2 and 3 give a comparison of a typical sleep profile during depression and full remission of the same patient (male, age 33 years, bipolar type of depression).

The sleep profile during depression shows a shortened REM sleep latency (Kupfer, 1976; Dirlich et al., 1978) and a displacement of sleep Stages 3 and 4 which normally precede the first REM sleep phase. During sleep there are frequent spontaneous awakenings very often out of Stage 2 sleep. Early morning awakenings are not typical for the male patient. Sleep profiles of severely depressed patients can be distorted far more than is the case in this patient with a moderate depression. As can be seen from Figure 3, the sleep profile looks less distorted during remission.

Disturbances at the Level of Consecutive Sleep Records

The sleep pattern of depressed patients shows marked day to day fluctuations. Therefore only the assessment of more than a single night gives a clear picture of the sleep disturbances during depression.

Figure 4 shows the distribution of REM and NREM sleep phases in 11 consecutive nights of a female patient (age 56 years) with a severe unipolar depression. The patient was without medication in the first 8 nights, but then received an antidepressive medication. As can be seen, extremely reduced REM sleep latencies are typical for nearly all nights of the study. In addition, the first REM sleep phase, which is about 15 min long in normal subjects, is much longer in this patient (49.3 ± 22.2 min). Besides a reduction in the REM sleep latency, a lengthening of the first REM sleep phase is seen quite often in endogenously depressed patients.

In Figure 5 the REM/NREM sleep pattern of 21 consecutive nights of another patient (same patient as in Figure 2) is represented. In this patient REM sleep latency is shortened, but only in 4 out of 21 nights. There is also a marked day to day fluctuation in the length of the first REM sleep phase (34.7 ± 26.4 min). This variation in the length and latency of the first REM sleep period is much greater during depression than during full remission or in healthy subjects.

The observation of marked fluctuations on the level of consecutive sleep records raises the question whether or not these nightly variations in sleep measures coincide with variations in other variables.

As Sachar et al. (1973) have already shown, there is episodic excretion of cortisol during the first half of the night in depressed patients but not in healthy subjects. In agreement with Sachar's results we found an increased excretion of free cortisol in urine between 2200 h and 0230 h in most of our patients. The female patient whose sleep data were presented in Figure 4 shows a positive correlation between UFC excretion in the first half of the sleep period and the length of the first REM sleep phase (see Fig. 6).

A relationship between indicators of disturbed REM sleep and cortisol excretion may also be seen in the data of the male patient mentioned earlier. A negative rank correlation between REM sleep latency and UFC excretion during depression ($r_s = -0.46$) was found. During remission when the correlation is even higher ($r_s = -0.72$) there is an occurrence of a sleep onset REM phase and, in the same night (No. 11), an extremely high UFC excretion (Fig. 7).

These data indicate that the inter-night variations of different functions are in some way correlated and may be the result of a common central disturbance.

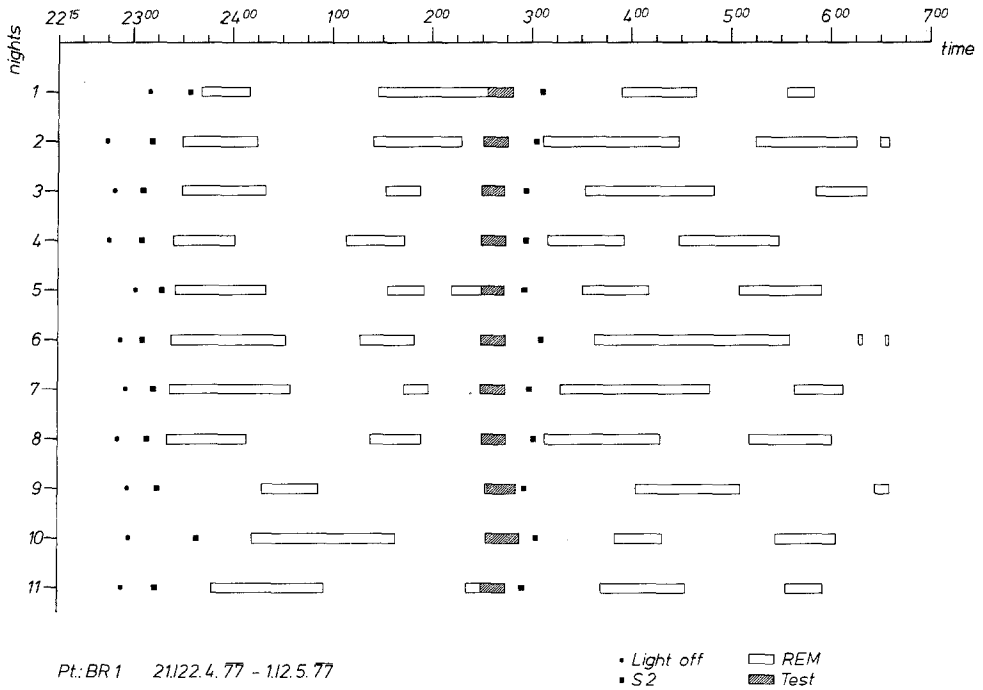

Fig. 4. REM-NREM sleep pattern of a female depressed patient over 11 consecutive nights. REM sleep phases are displayed as open bars. The dashed bars represent the forced awakenings at about 0230 h. The dots represent 'lights out', the black squares indicate sleep onset (first S2) and first S2 after the forced awakenings

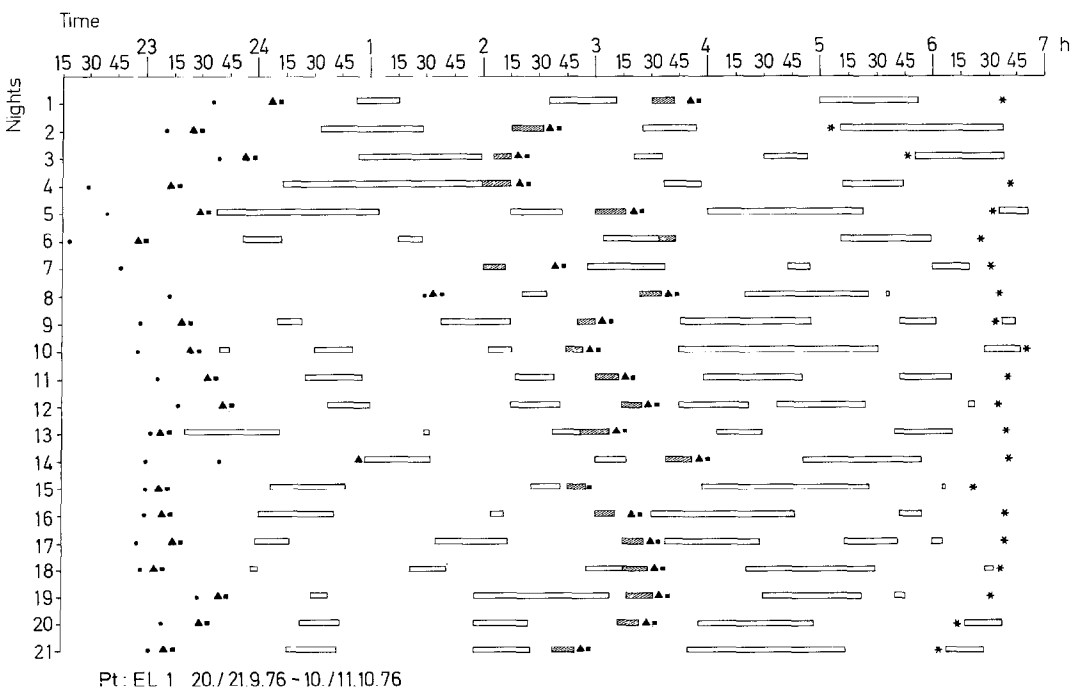

Fig. 5. REM-NREM sleep pattern of a male depressed patient over 21 consecutive nights. Notation as in Figure 4. In addition there are black triangles indicating first Stage 1 and black stars for the last epoch of Stage 2 sleep in the night

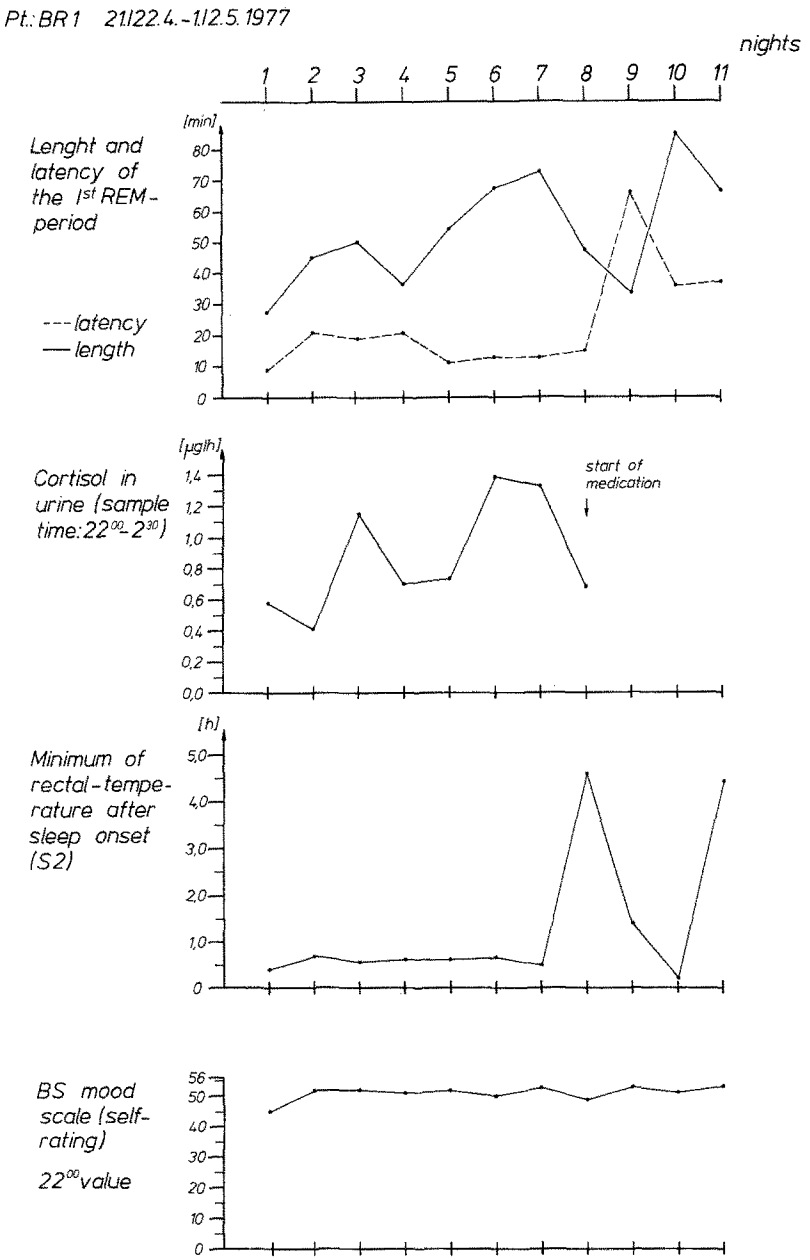

Fig. 6. Parameters of REM sleep, UFC excretion, rectal temperature, and mood scale of a female depressed patient (same patient as in Figure 4) over 11 nights

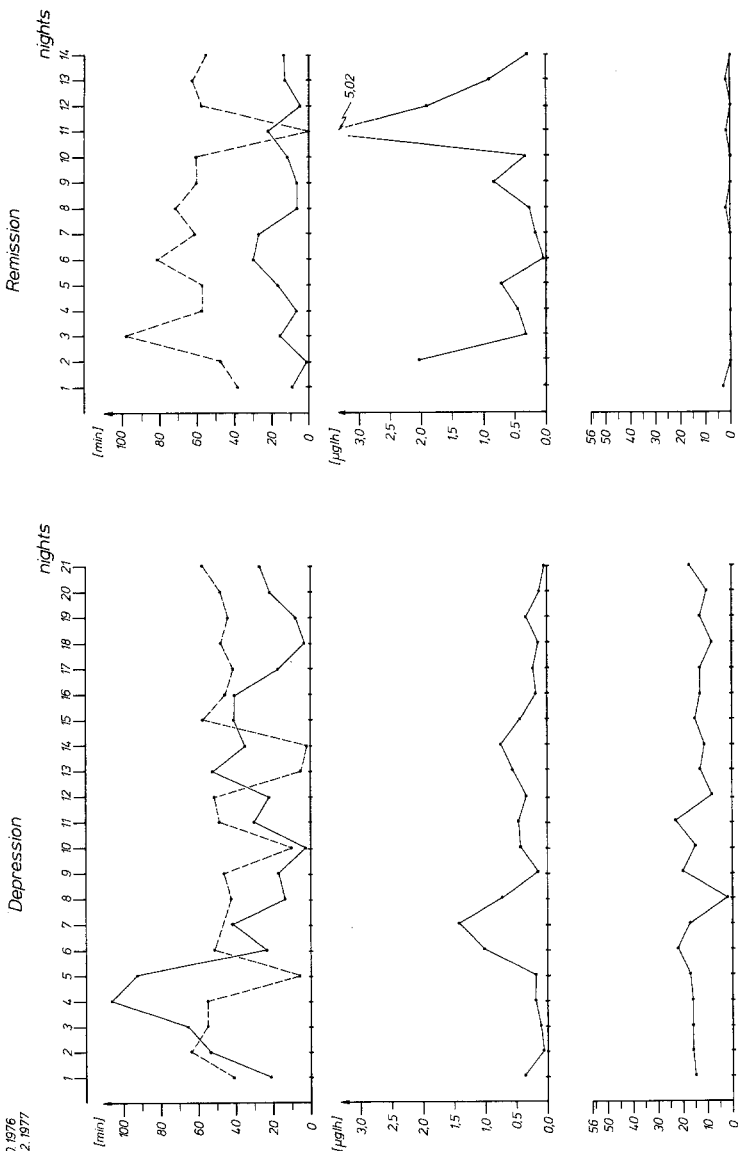

Fig. 7. Parameters of REM sleep, UFC excretion and mood scale of a male depressed patient (same patient as in Figure 5). At the left side of the figure the data from 21 consecutive sleep periods during depression are represented, at the right side of the figure the data from 14 sleep records during full remission

References

Atkinson, M., Kripke, D. F., Wolf, S. R.: Autorhythmometry in Manic-Depressives. Chronobiologia **2**, 325—335 (1975)

Coble, P., Foster, F. G., Kupfer, D. J.: Electroencephalographic sleep diagnosis of primary depression. Arch. Gen. Psychiatry **33**, 1124—1127 (1976)

Dirlich, G., Schulz, H., Lund, R.: Increase of SOREMP frequency in endogeneous depression. Association for the Psychophysiological Study of Sleep, 18th Annual Meeting, April 5—9, 1978, Palo Alto, Calif., USA

Hauri, P., Hawkins, D. R.: Alpha-delta-sleep. Electroencephalogr. Clin. Neurophysiol. **34**, 233—237 (1973)

Kupfer, D. J.: REM Latency: a psychobiologic marker for primary depressive disease. Biol. Psychiatry **11**, 159—174 (1976)

Mendelson, W. B., Gillin, J. C., Wyatt, R. J. (Eds.): Human sleep and its disorders. New York: Plenum Press 1977

Pflug, B., Erikson, R., Johnson, A.: Depression and daily temperature. Acta Psychiatr. Scand. **54**, 254—266 (1976)

Rechtschaffen, A., Kales, A. (Eds.): A manual of standardized terminology, techniques and scoring system for sleep stages of human subjects. Washington, D. C.: U. S. Government Printing Office (Public Health Service) 1968

Sachar, E. J., Hellman, L., Roffwarg, H. P., Halpern, F. X., Fukushima, D. K., Gallagher, T. F.: Disrupted 24-hour patterns of cortisol secretion in psychotic depression. Arch. Gen. Psychiatry **28**, 19—24 (1973)

Williams, R. L., Karacan, I., Hursch, C. J.: Electroencephalography (EEG) of human sleep: Clinical applications. New York: Wiley 1974

Zerssen, D. v., Koeller, D.-M.: Klinische Selbstbeurteilungs-Skalen (KSb-S) aus dem Münchner Psychiatrischen Informations-System (Psychis München). Manuale. Weinheim: Beltz 1976

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