than those for the night sleep suggests a stronger need for the D-state
or, at any rate, some of its components. It also demonstrates a different
balance between the circadian and intra-sleep influences.
4. There seems to exist a certain difference between the phasic manifestations
(number of EM) and the tonic manifestations (length of D-periods).
In fact, the relationship length per latency is very clear though
not linear at night as well as in the daytime, suggesting that the relationship
depends on intra-sleep cycling. The relationship number of EM per
latency is less clear, which may indicate that it depends more on the circadian
influence.

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Sleep: Physiology, Biochemistry, Psychology, Pharmacology, Clinical Implications.

Application of Electronic Noise and Pulsed Magnetic
Field in the Treatment of Sleep Disorders

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Electronic wide-band noise (WBN) is being used for cerebral electrotherapy
of sleep disorders, as it is not unlikely that neurones actively select
convenient frequencies, whereas other frequencies are rejected by semiconductive
Fig. 1. The presence of wide-band noise in the deep regions of the brain (lower recording) during orbito-occipital application of noise produced by Electrorel GJP (the source in the upper recording). CH = standards of voltage, Horiz. = speed of the horizontal shift.

non-linear ionic systems fl, 2, 3]. In our institute, the electronic noise is produced by a specially developed transistorized apparatus Electrorel GJP.

In an experiment in which we monitored the passage of electronic noise in the rabbit’s brain during orbito-occipital application, we could demonstrate the presence of WBN in the deep regions of the brain (fig. 1). Potentials produced in hypothalamic regions by application of 1-5 mA electronic noise were 70-600 times higher than spontaneous potentials.

We investigated a group of 23 neurotics and depressives with insomnia, treated with: (1) WBN without direct current (DC) component (using Electrorel GJP); (2) rectangular pulses, pulse current (PC), superimposed upon stable DC current (using Russian equipment, Elektroson 2), and (3) placebo, i.e. sham treatment (ST). Application of WBN, PC and ST varied randomly. With all three forms of therapy we investigated the changes of the electric skin conductivity (ESC) every minute for 20 min before and 20 min after the application of treatment. The values of the 120 determinations of the ESC in every patient were submitted to a computer. Figure 2 shows the arithmetic mean and the average deviations for the ESC for all patients with the three different applications. We found that the arithmetic mean

Fig. 2. Arithmetic mean values and deviations of the ESC (electric skin conductivity) of all patients in the following three different treatments: Placebo; Elektroson 1; Sum (Electrorel GJP). Lines = control values; rectangles = effects.

of the ESC increased after ST, remained unchanged after the application of the Elektroson 2, and decreased after the application of the WBN by Electrorel GJP. The decrease of ESC after WBN treatment suggests a shift in the autonomic sphere and higher regulatory activities in the direction of increased inhibition and of a preponderance of the parasympathetic system. Subjective evaluation revealed that in the 23 patients of the group ST improved sleep three times, PC did so four times and WBN 9 times.
Another group of 47 neurotics and depressive patients was treated by short pulses of magnetic field (PMF) using as experimental equipment the Magnetodiapulse apparatus. 1-msec trains of 27 MHz were applied 9 times/sec for 1 h through non-contacting wire coil parietal electrodes. After the application of PMF, 28 of the 47 patients complained about a feeling of excitation associated with headache; 12 patients reported a feeling of tension or unpleasant exhaustion and 7 patients signalled drowsiness. After ST, feelings of excitation were mentioned by four patients, 9 patients reported tension or exhaustion and 34 felt drowsy but stressed their good tolerance of the treatment. Already from this simple statistic we may deduce that PMF produces irritation. It remains to be shown whether this irritation effect is of long duration and whether it is possible to exploit it as therapeutic means for mental diseases of the depressive type.

In this connection we should mention that last year we followed for 190 days the effects of slow pulsations of the geomagnetic field on neurotic complaints. The statistical analysis of the data obtained from a group of 40 neurotic patients revealed that there were significantly more favorable reactions on days with geomagnetic activity of medium level but significantly more unfavorable reactions on days with imperceptible geomagnetic activity. It should be mentioned that the slow daily geomagnetic pulses cover the range of from 1CT4 to $7 \times 10^{-2}$Oe. These small and slow changes of the magnetic fields cannot be recorded by any of the presently known types of bodily receptors. Consequently they cannot influence directly bioelectric processes in the central nervous system. But since we were able to demonstrate in our experimental group effects of these imperceptible changes of the geomagnetic field, we must assume that in the organism there exist special receptor structures, also there must exist specific electrophysiological amplifiers, as only after amplification in range $10^6$ does it appear feasible to reason about an influence upon electrophysiologic processes in neurons. Also it is not unlikely that there exist in an organism semiconducting systems with nonlinear characteristics.

Concerning the data of our clinical work we believe that these results suggest the possibility of novel therapeutic means for many types of insomnia and as well as for various psychiatric diseases such as neurotic syndromes and reactive depressions.

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