PHYSIOLOGY

Effect of Δ-Rhythm-Modulated Extremely High Frequency Electromagnetic Radiation on Rats

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Extremely high frequency electromagnetic radiation modulated with a frequency equal to cerebral Δ-rhythm oscillations induced electrosleep in rats.

Key Words: *electromagnetic radiation; extremely high frequency; rats; electrosleep*

Intrinsic integrative electromagnetic field can be transferred from one organism to another by low intensity extremely high frequency electromagnetic radiation (EHF EMR) [2]. Hopefully, further progress in this field will lead us to novel non-medication approaches to treating and correcting physiological status of human organism on the basis of spatial modulation of low-intensity EHF EMR in the immediate proximity to bioactive zones. The revealed effect corroborates the phenomenon of "field transfer" of biological informa-tion. It is a cornerstone of experiments aimed at the search for new ways of distant action on the organism via focusing EHF EMR of non-thermal intensity ($P<10$ mW/cm^2) on bioactive points.

Here we studied transfer of biological information immanent to CNS activity during electrosleep using a EHF EMR carrier.

Electrosleep is a routine and widely used procedure in medicine. It is induced by electric current with a frequency corresponding to Δ-rhythm (f_ΔH~3.5 Hz for mammals [5]), which is delivered to certain points on the head via contact electrodes. Deep sleep induced by this electric stimulation is widely used in diagnostics and therapy of various diseases.

Our aim was to test in experiments the possibility of electrosleep induced by EHF EMR modulated at $\Omega_{mod}=f_\Delta$. In addition to progress in diagnostics and therapy, demonstration of EHF-electrosleep will create scientific basis for further improvement of field-based therapeutic procedures.

MATERIALS AND METHODS

Experiments were carried out on mature Wistar rats during spring-summer under various geophysical conditions in a quiet sun year. This protocol excluded the effects of geophysical factors, to which the mammals are very sensitive.

We used EHF EMR with a carrier frequency of 37 GHz, flux surface density at the body surface $P<0.3$ mW/cm^2, and modulation frequency $\Omega_{mod}=3.5$ Hz, which corresponded to Δ-rhythm of the brain during deep sleep (Fig. 1).

The most active animals were selected for this study. All experiments were carried out in the morning from 8:00 to 13:00. The rats were not fed in the morning. This experimental paradigm excluded the possibility of natural physiological sleep. Moreover, natural noises were not excluded during the experiments; the rats were persistently subjected to natural stimulation with bright light and loud sounds. All these factors promoted active behavior of the control rats and experimental animals before irradiation.

In each experimental series rat behavior was assessed before irradiation.

First, the effect of non-modulated EHF EMR on rat behavior was examined; the duration of irradiation

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was no less than 2 h. Then, the experimental rats were exposed to EHF EMR modulated at Ω_{mod}=15 Hz, *i. e.* at a frequency far surpassing Δ-rhythm, but lower than β-rhythm (f_β=18.75 Hz).

During the experiment, the control rats were placed in the working chamber identical to that of irradiated rat.

RESULTS

The behavior of rats exposed to non-modulated EHF EMR did not differ from their initial behavior (stage 1). All rats demonstrated active and in some cases even aggressive behavior. After irradiation, the experimental rats were returned to their cage, where their behavior did not principally differ.

At stage 2, the experimental rats settled down; their behavior became passive within the first 25-30 min of irradiation. Then deep sleep was induced, during which the rats did not respond to bright light and loud sound. The duration of sleep corresponded to that of irradiation with Δ-rhythm-modulated EHF EMR. The maximum duration of induced sleep was 5 h.

During stage 2, irradiation was turned off or the frequency of the low-frequency generator was changed from Δ- to β-rhythm 1 or 2 h after the onset of electrosleep. All these manipulations resulted in rapid awakening, while resumption of irradiation with Δ-rhythm-modulated EHF EMR after non-radiation period or β-rhythm-radiation again provoked deep sleep.

At the end of the experiments, all experimental rats awoke and their behavior did not differ from that during the initial period. In two rats, enhanced aggressiveness was observed immediately after the end of the experiment. Behavior of control rats did not significantly differ during the entire period of observation: they demonstrated active behavior, adequately reacted to external stimuli, fed, and tried to leave the working chamber.

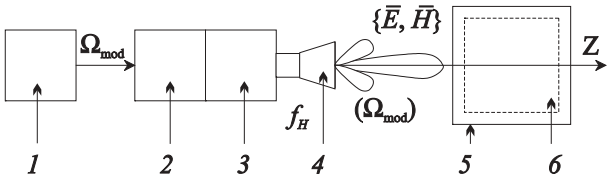

Fig. 1. Scheme of experiment. *1*) low-frequency generator; *2*) extremely-high-frequency generator; *3*) modulator; *4*) feed horn; *5*) working chamber; *6*) irradiated rat.

Further observation revealed no significant behavioral changes.

Thus, our experiments revealed a new biological effect of electrosleep induced by non-thermal Δ-rhythm-modulated EHF EMR. These findings can be interpreted by the theory of resonance interaction of electromagnetic field with living organism [2]; they corroborate the existence of this interaction, and substantiate experimentally the practical use of EHF electrosleep in diagnostics and therapy.

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