ALTERATION OF REPEATED ACQUISITION IN RATS BY MICROWAVE RADIATION

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The acute effects of microwave radiation on a repeated acquisition (learning) baseline were investigated in three rats. During each session the animals acquired a different four-member response sequence. Each of the first three correct responses advanced the sequence to the next member, and the fourth correct response produced food reinforcement. Incorrect responses produced a three-sec timeout. Responses during timeout reset the timeout period. Baseline and harness control sessions were characterized by a decrease in errors within each session. The animals were restrained in a plastic sleeve harness and exposed to a pulsed 2800 MHz field for 30 min prior to experimental sessions. Microwave power densities ranging from 0.25 to 10.0 mW/cm^2 were investigated. Specific absorption rates calculated from core temperature measurements yielded mean values of 0.72 and 1.73 mW/gm at the 5 and 10 mW/cm^2 power densities, respectively. At 0.25, 0.5, and 1.0 mW/cm^2 the behavioral measures were generally within the control range. At 5 mW/cm^2, error responding, rate of sequence completion, and the pattern of within-session acquisition were altered in two of four replications. Exposure to 10 mW/cm^2 increased errors, decreased the rate of sequence completion, and altered the pattern of within-session acquisition in all replications.

Summary

This presentation describes the acute effects of microwave radiation on a repeated acquisition (learning) baseline with rats. During each session the animals were required to learn a different four-member response sequence to produce food reinforcement. Three manipulanda were present in the chamber, designated left (L), center (C), and right (R), and each was included in every sequence. Each member of the sequence was associated with a different auditory stimulus and the stimuli were always presented in the same order. The correct order of responses, however, changed from session to session (i.e., LRCL, RCRL). Each of the first three correct responses advanced the sequence to the next member and the fourth correct response produced reinforcement. Incorrect responses produced a 3-sec timeout. Responses during timeout reset the timeout period. Neither incorrect nor timeout responses reset the sequence. During baseline and harness control sessions all subjects displayed a biphasic response pattern characterized by an initial increase in accuracy (decrease in error responding), which reached a stable (performance) level as the session progressed.

After baseline responding had stabilized, the animals were adapted to a plastic sleeve holder. Once adaptation was accomplished a series of microwave exposures was begun. The animals were exposed to microwave irradiation immediately before experimental sessions one or two days a week in a 512 ft^3 anechoic chamber. Exposure was 30 min in duration and experimental sessions began within 5 min of the end of exposure. During exposures the animals were aligned so that the electric component of the microwave field was perpendicular with respect to the long axis of the animals' body. The animals were placed approximately 6 wavelengths from the center of a standard gain horn antenna. They were exposed to a pulsed 2800 MHz field (2 μsec, 500 Hz). Five incident power densities were investigated: 0.25, 0.5, 1.0, 5.0, and 10.0 mW/cm^2 average power, with peak powers of 0.25, 0.5, 1.0, 5.0, and 10.0 watts, respectively. The exposures were conducted in a mixed order with each power level presented a minimum of three times. Throughout the exposure series sham irradiations were conducted. These consisted of placing the animal in the holder in the radiation chamber for 30 min in the absence of forward power. The sham irradiations and baseline sessions conducted between acute exposures constituted the control sessions against which microwave effects were measured. A normal baseline session always followed either a sham irradiation or microwave irradiation session. Core temperature of the rats was measured under conditions of sham irradiation and irradiation, in the holder, with a Digitec model 251A digital thermometer and Yellow Springs Instrument Co. Model 702 rectal temperature probe. Specific absorption rates (SAR) calculated from the irradiation measurements resulted in values of 0.72 and 1.73 mW/gm for the 5 mW/cm^2 and 10 mW/cm^2 incident power densities,

respectively. In comparison to control sessions, the results at 0.25, 0.5, and 1.0 mW/cm^2 were generally within the control range. At 5 mW/cm^2 two of four replications showed behavioral alterations. In those sessions, error responding increased, the rate of sequence completion decreased, and the within-session transition from learning to performance was irregular and delayed. Exposure to 10 mW/cm^2 increased error responding, decreased the rate of sequence completion, and virtually abolished the within-session transition from learning to performance in all animals in each replication. These results demonstrate the sensitivity of repeated acquisition as a procedure for detecting the effects of low-level microwave radiation.