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1: J Microw Power. 1979 Dec;14(4):389-98.

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Microwave irradiation and ambient temperature interact to alter rat behavior following overnight exposure.

Gage MI.

Each of twelve male hooded rats was trained to insert its head into a food cup for food pellets on a random-interval schedule of reinforcement. After performances stabilized, the rats were assorted into 3 groups of 4 animals. Groups were matched for response rates. Animals were exposed in groups of 4 for 15.5 h to CW 2450-MHz microwaves once every 6 nights. Animals of each group were exposed to microwaves at only one power density, either 5, 10, or 15 mW/cm2; they were exposed three times at an ambient temperature of 22 degrees C, then three times at 28 degrees C, and then once more at 22 degrees C. The relative humidity was 50% during all exposures. Rats were sham irradiated (at 0 mW/cm2) the night before each microwave exposure. Behavior was tested daily after termination of microwave irradiation or after sham exposures. None of the exposures to microwaves at 22 degrees C altered rates or durations of responding. Exposures at 28 degrees C reduced response rates and increased response durations in direct relation to the power density. The results are interpreted as the transient debilitation of behavior produced by the interaction of a mild elevation of ambient temperature and microwave irradiation.

PMID: 261599 [PubMed - indexed for MEDLINE]

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Ne pas utiliser le portable 28°C si le temps/est !

1: Bioelectromagnetics. 1982;3(1):105-16.

Photic cuing of escape by rats from an intense microwave field.

Levinson DM, Grove AM, Clarke RL, Justesen DR.

A total of 16 female hooded rats was first observed for baseline behaviors and then they received 25 2-min trials of training, five trials per day, under one of four stimulus conditions (all ns = 4): exposure to a highly intense 918-MHz field (dose rate, 60 mW/g); exposure to photic stimulation (approximately 350 lx); exposure to the field in synchrony with photic stimulation; or exposure to faradic shock (approximately 800 micro A rms). During conditioning trials, which were separated by 2-min intertrial intervals, entry by a rat into a safe area of a multimode cavity resulted in immediate and complete cessation of stimulation; exit, in resumption. Acquisition of the escape response was rapid and highly efficient for shocked animals and was less rapid and efficient but was reliably demonstrated by irradiated animals that were also signaled by light. In the absence of microwave irradiation, cessation of light did not reliably motivate escape behavior. Although there was weak evidence of escape learning by rats subjected only to microwave irradiation, their performance failed to differ reliably from those of rats in the light-only condition. These data confirm and extend those of Carroll et al, which indicate that potentially lethal, deeply penetrating, nonpulsed microwaves in a multipath field lack the sensory quality to motivate efficient aversive behavior by the rat.

PMID: 7082382 [PubMed - indexed for MEDLINE]

On ne s'en échappe pas ni pour la dose et potentiellement mortelle.

Failure of rats to escape from a potentially lethal microwave field.

Carroll DR, Levinson DM, Justesen DR, Clarke RL.

Ocularly pigmented rats, all mature females of the Long-Evans strain, were repeatedly presented an opportunity to escape from an intense 918-MHz field (whole-body dose rate = 60 mW/g) to a field of lower intensity (40, 30, 20, or 2 mW/g) by performing a simple locomotor response. Other rats could escape 800-microamperemeter faradic shock to the feet and tail by performing the same response in the same milieu, a multimode cavity. None of 20 irradiated rats learned to associate entry into a visually well-demarcated area of the cavity with immediate reduction of dose rate, in spite of field-induced elevations of body temperature to levels that exceeded 41 degrees C and would have been lethal but for a limit on durations of irradiation. In contrast, all of ten rats motivated by faradic shock rapidly learned to escape. The failure of escape learning by irradiated animals probably arose from deficiencies of motivation and, especially, sensory feedback. Whole-body hyperthermia induced by a multipath field may lack the painful or directional sensory properties that optimally promote the motive to escape. Moreover, a decline of body temperature after an escape-response-contingent reduction of field strength will be relatively slow because of the large thermal time constants of mammalian tissues. Without timely sensory feedback, which is an essential element of negative reinforcement, stimulus-response associability would be imparied, which could retard or preclude learning of an escape response.

PMID: 7284019 [PubMed - indexed for MEDLINE]

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1: Gig Sanit. 1991 Aug;(8):52-3. Related Articles, Links

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[Behavioral effects of the combined chronic action of 9375 and 1765 MHz microwaves]

[Article in Russian]

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Navakatikian MA, Nikitina NG, Zotov SV.

Combined pulse-discrete microwave irradiation (9375 and 1765 MHz, irradiance flux density to 375 microW/cm2, by 12 h/day for 4 months) caused faint inhibition of CNS in locomotion activity and defensive reflex parameters.

PMID: 1937100 [PubMed - indexed for MEDLINE]

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1765 = Rougeoles

4 mois 375 µW/cm² = conditions de portable

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1: Radiobiologiia. 1986 May-Jun;26(3):365-71.

Related Articles, Links

[Systemic effects of the interaction of an organism and microwaves]

[Article in Russian]

Suvorov NB, Vasilevskii NN, Ur'iash VV.

A study was made of the dynamics of neurophysiological processes, the autonomic nervous system reactions, and the behaviour of cats during long-term electromagnetic field (EMF) exposure (500 mu W/cm2, 2375 MHz). Revealed were the synchronization of the brain bioelectrical activity at 6-10 Hz and 12-16 Hz, different EMF sensitivity of the brain structures, the heart rate decrease, and the increase in the mobility and aggression of the animals. A complex of interrelated changes occurring virtually in all functional systems of the organism should be considered as a specific EMF effect.

PMID: 3737885 [PubMed - indexed for MEDLINE]

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synchronisation de l'EEG très basse fréquence émise 500 µW/cm² (puissance admise pour le portable)

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1: Radiats Biol Radioecol. 1995 Jan-Feb;35(1):29-35. Related Articles, Links

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[Motor activity of rabbits in conditions of chronic low-intensity pulse microwave irradiation]

[Article in Russian]

PubMed Services

Grigor'ev IuG, Luk'ianova SN, Makarov VP, Rynskov VV, Moiseeva NV.

Motor activity of rabbits under daily thirty-minute irradiation (1.5 GHz, pulse duration 16 ms, pulse recurrence frequency 0.12 Hz, pulse intensity 0.3 mw/cm2) for one month was studied. From 14th day the reliable disadaptation changes such as an anxiety and alarm reaction were found. The importance of prolonged irradiation is noted.

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PMID: 7719427 [PubMed - indexed for MEDLINE]

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effet à partir du 14e jour

Modification of the repeated acquisition of response sequences in rats by low-level microwave exposure.

Schrot J, Thomas JR, Banvard RA.

The acute effects of microwave exposure on a repeated acquisition baseline were investigated in three rats. 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-second timeout. Baseline and control sessions were characterized by a decrease in errors within each session. The animals were acutely exposed to a 2.8 GHz pulsed-microwave field prior to test sessions, with average power densities ranging from 0.25 to to 10 mW/cm2. In comparison to control sessions, 1/2 hour of exposure to microwave radiation at power densities of 5 and 10 mW/cm2 increased errors and altered the pattern of within-session acquisition. Exposure to the 10 mW/cm2 power density decreased the rate of sequence completion in all animals. The results of exposures at 0.25, 0.5, and 1 mW/cm2 power densities were generally within the control range. The results are interpreted as indicating a disruption in the discriminative stimulus control of the repeated acquisition behavior.

PMID: 7284018 [PubMed - indexed for MEDLINE]

1: Bioelectromagnetics. 1987;8(1):45-55.

Microwave facilitation of domperidone antagonism of apomorphine-induced stereotypic climbing in mice.

Quock RM, Kouchich FJ, Ishii TK, Lange DG.

The dopaminergic agonist apomorphine produced dose-dependent stereotypic climbing behavior in mice housed in cages with vertical bars. This drug effect was competitively inhibited by systemic pretreatment with the centrally acting dopaminergic antagonist haloperidol but not by microwave irradiation (2.45 GHz, 20 mW/cm2, CW, 10 min) nor by systemic pretreatment with domperidone, a dopaminergic antagonist that only poorly penetrates the blood-brain barrier (BBB). Yet when mice were systemically pretreated with domperidone and then subjected to microwave irradiation (as above), the apomorphine effect was significantly reduced. Microwave irradiation also facilitated antagonism of the apomorphine effect by low and otherwise ineffective systemic pretreatment doses of haloperidol. Apomorphine-induced stereotypic climbing behavior was also reduced by domperidone administered intracerebrally, which bypassed the BBB. Exposure of intracerebral domperidone-pretreated animals to microwave irradiation failed to increase the degree of antagonism. These findings indicate that microwave irradiation can facilitate central effects of domperidone, a drug which acts mainly in the periphery. One possible explanation for these findings is that microwave irradiation alters the permeability of the BBB and increases the entry of domperidone to central sites of action.

PMID: 3579999 [PubMed - indexed for MEDLINE]

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1: Pharmacol Biochem Behav. 1986 Jan;24(1):151-3. Related Articles, Links

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Low-level microwave irradiation attenuates naloxone-induced withdrawal syndrome in morphine-dependent rats.

Lai H, Horita A, Chou CK, Guy AW.

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The effect of microwave irradiation on naloxone-induced withdrawal syndrome was studied in rats made morphine dependent by subcutaneous implantation of morphine pellets. Morphine-dependent rats were either exposed to pulsed low-level microwaves (2450 MHz, 1 mW/cm2, 500 pps, 2 musec pulses) or sham-irradiated for 45 min before the naloxone injection. We found that microwave-exposed rats showed significantly less weg-dog-shakes and had higher body temperature than the sham-exposed animals during withdrawal. There was no significant difference in the incident of diarrhea between the two groups of animals. These data further support the results of our previous research suggesting that pulsed low-level microwave irradiation activates endogenous opioids in the rat.

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1: Bioelectromagnetics. 1986;7(1):45-56. Related Articles, Links

Behavioral and physiological effects of chronic 2,450-MHz microwave irradiation of the rat at 0.5 mW/cm2.

D'Andrea JA, DeWitt JR, Gandhi OP, Stensaas S, Lords JL, Nielson HC.

Adult male Long-Evans rats were intermittently exposed to 2450 MHz CW microwaves at an average power density of 0.5 mW/cm2 for 90 days. The resulting SAR was 0.14 W/kg (range 0.11 to 0.18 W/kg). The animals were exposed 7 h/day, 7 days/wk, for a total of 630 h in a monopole-above-ground radiation chamber while housed in Plexiglas holding cages. Daily measures of body mass and food and water intake indicated no statistically significant effects of microwave exposure. Monthly assessment of reactivity to electric footshock, levels of cholinesterase and sulfhydryl groups in blood, and 17-ketosteroids in urine revealed no reliable differences between 14 sham-exposed and 14 microwave-exposed rats. After the 90 days of exposure, seven rats, randomly chosen from each group, were assessed for open-field behavior, shuttlebox performance, and schedule-controlled (IRT schedule) lever pressing for food pellets. Statistically significant differences between microwave-exposed and sham-exposed rats were observed in shuttlebox performances and lever pressing. Post mortem measures of mass of several organs and microscopic examination of adrenal tissue revealed no differences between the two groups of animals.

PMID: 3730001 [PubMed - indexed for MEDLINE]

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Minimal changes in hypothalamic temperature accompany microwave-induced alteration of thermoregulatory behavior.

Adair ER, Adams BW, Akel GM.

This study probed the mechanisms underlying microwave-induced alterations of thermoregulatory behavior. Adult male squirrel monkeys (Saimiri sciureus), trained to regulate the temperature of their immediate environment (Ta) behaviorally, were chronically implanted with Teflon reentrant tubes in the medical preoptic/anterior hypothalamic area (PO/AH), the brainstem region considered to control normal thermoregulatory processes. A Vitek temperature probe inserted into the tube measured PO/AH temperature continuously while changes in thermoregulatory behavior were induced by either brief (10-min) or prolonged (2.5-h) unilateral exposures to planewave 2,450-MHz continuous wave (CW) microwaves (E polarization). Power densities explored ranged from 4 to 20 mW/cm2 (rate of energy absorption [SAR] = 0.05 [W/kg]/cm2]). Rectal temperature and four representative skin temperatures were also monitored, as was the Ta selected by the animal. When the power density was high enough to induce a monkey to select a cooler Ta (8 mW/cm2 and above), PO/AH temperature rose approximately 0.3 degrees C but seldom more. Lower power densities usually produced smaller increases in PO/AH temperature and no reliable change in thermoregulatory behavior. Rectal temperature remained constant while PO/AH temperature rose only 0.2-0.3 degrees C during 2.5-h exposures at 20 mW/cm2 because the Ta selected was 2-3 degrees C cooler than normally preferred. Sometimes PO/AH temperature increments greater than 0.3 degrees C were recorded, but they always accompanied inadequate thermoregulatory behavior. Thus, a PO/AH temperature rise of 0.2-0.3 degrees C, accompanying microwave exposure, appears to be necessary and sufficient to alter thermoregulatory behavior, which ensures in turn that no greater temperature excursions occur in this hypothalamic thermoregulatory center.

PMID: 6712747 [PubMed - indexed for MEDLINE]

8 mW/cm² = + 93°C ↑ grave !
du centre hypothalamique

1: Environ Health Perspect. 1979 Jun;30:115-21.

Related Articles, Links

Study of nonionizing microwave radiation effects upon the central nervous system and behavior reactions.

Shandala MG, Dumanskii UD, Rudnev MI, Ershova LK, Los IP.

The biologic effect of an electromagnetic field of a frequency of 2375 +/- 50 MHz was studied in rats and rabbits in specially constructed absorbant chambers. The results of the investigations have shown that microwave radiation of 10, 50, 500 mu W/cm2 for 30 days, 7 hr/day, causes a number of changes in bioelectric brain activity and also in behavioral immunological, and cytochemical reactions. It was found that levels of 10 and 50 mu W/cm2 stimulate the electric brain activity at the initial stage of irradiation, while a level of 500 mu W/cm2 causes its suppression, as seen from the increase of slow, high amplitude delta-waves. At 500 mu W/cm2 a decrease in capacity of work, in value of unconditioned feeding stimulus, in investigating activity, electronic irradiation threshold, and in inhibition of cellular and humoral immunity were also observed.

PMID: 446442 [PubMed - indexed for MEDLINE]

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1: Bioelectromagnetics. 1984;5(2):213-20.

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Ethanol-induced hypothermia and ethanol consumption in the rat are affected by low-level microwave irradiation.

Lai H, Horita A, Chou CK, Guy AW.

Microwave irradiation of rats by circularly polarized, 2,450-MHz, pulsed waves (2-microseconds pulses; 500 pps) was performed in waveguides to determine effects on ethanol-induced hypothermia and on ethanol consumption. Rats injected intraperitoneally with ethanol (3 g/kg in a 25% v/v water solution) immediately after 45 min of microwave irradiation exhibited attenuation of the initial rate of fall in body temperature, which was elicited by the ethanol, but exhibited no significant difference in maximal hypothermia as compared with that of sham-irradiated rats. Microwave irradiation did not affect the consumption of a 10% sucrose (w/v) solution by water-deprived rats. However, it enhanced the consumption of a solution of 10% sucrose (w/v) + 15% ethanol (v/v) by water-deprived animals. These results were obtained at a specific absorption rate (SAR) of 0.6 W/kg, which rate of energy dosing would require a power density of 3-6 mW/cm2 if exposure of the animals had occurred to a 12-cm plane wave.

PMID: 6732877 [PubMed - indexed for MEDLINE]

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↑ absorption éthanol
sous effet de MO
si privation d'eau

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1: Radiobiologiia. 1988 Jan-Feb;28(1):120-5.

Related Articles, Links

[Changes in the activity and conditioned-reflex behavior of white rats during and after chronic microwave irradiation]

[Article in Russian]

Navakatikian MA.

Albino rats were exposed to chronic (1-3 months) electromagnetic radiation (2375 MHz; 1, 5, 10, 50 and 500 microW/cm2; 7 hours a day). Inhibition of the activity during the open field tests and diminution of consolidation of the defence conditioned reflexes in a shuttle chamber occurred during exposure (5 to 500 microW/cm2) while the activity increased and reflexes consolidation gradually normalized during the post-irradiation period.

PMID: 3344322 [PubMed - indexed for MEDLINE]

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