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Cell Responses To GSM-1800 MHZ Electromagnetic Fields In The Rat Brain Affected By An Acute Inflammation

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The extensive use of wireless communications has raised public health concerns, which stimulate investigations of how electromagnetic fields (EMF) oscillating in the radiofrequency (RF) range might affect organs at cell and molecular levels. Brain cell responses triggered by head or whole-body exposure to RF have been extensively studied in healthy subjects. Less is known about the effect of these RF on the brain affected by a pathological process.

Lipopolysaccharide (LPS)-treated rodents model a human acute neuroinflammatory state triggered by benign peripheral infections, which affect many people each year, world-wide. We have investigated brain cells responses to a 2h single head exposure to GSM-1800 MHz in LPS-treated rats undergoing acute neuroinflammation. The analyses were carried out 3 to 72 h after the end of the GSM exposure, in different regions of the cerebral cortex in which the mean values of the specific absorption rate (SAR) varied between 1.55 W/kg and 3.22 W/kg. LPS-treated rats submitted to a sham exposure (null SAR values) served as the negative control. By recording the electrophysiological activity in the primary auditory cortex 3 to 6 h after the end of the GSM or sham exposures, we found that GSM-EMF triggered functional alterations in neuronal networks, as indicated by significant reductions in evoked responses to acoustic stimuli and an increase in response duration. GSM exposure also induced changes in the morphology of brain immune cells localized in the auditory cortex such as microglia, which consisted in a significant growth of microglial cell processes [1]. A similar growth of microglial cell processes could be observed in the dorsal part of the cingulate cortex (mean SAR value: 2.94 W/kg), 24h after the end of the GSM-exposure but this effect did not persist 72h post exposure [2]. Reverse transcription-quantitative PCR analyses and a genome wide mRNA profiling were carried out 24h post exposure, in a dorsal area of the cerebral cortex (mean SAR value: 3.22 W/kg) and showed significant but moderate (fold changes <2) modulations of transcripts levels affecting 2.7% of the expressed genes, including genes encoding proinflammatory mediators and genes involved in protein ubiquitination or dephosphorylation [3]. GSM-induced protein dephosphorylations were directly observed in glutamate ionotropic receptors that are known to be involved in excitatory neurotransmission [2]. Importantly, assessments of neuronal activity, microglia cell morphology, gene expressions and glutamate receptor phosphorylation showed no significant effect in healthy rats that were submitted to a same head-only exposure to GSM-EMF [1, 2, 3]. Together our analyses uncover alterations in brain cell functions, morphologies or genes, which are triggered by GSM-1800 MHz under neuroinflammatory conditions. We also show that pathological processes affecting the brain can promote brain cell responses to GSM-EMF. This research was supported by PNREST Anses (grants 2015/2 RF/12 and 2018/2 RF/1).

1. F. Occelli et al., "A Single Exposure to GSM- 1800MHz Signals in the Course of an Acute Neuroinflammatory Reaction can Alter Neuronal Responses and Microglial Morphology in the Rat Primary Auditory Cortex," *Neuroscience*, **385**, Aug 10 2018, pp. 11-24, doi: 10.1016/j.neuroscience.2018.06.002.

2. J. Lameth et al., "Acute Neuroinflammation Promotes Cell Responses to 1800 MHz GSM Electromagnetic Fields in the Rat Cerebral Cortex," *Neurotox Res*, **32**, 3, Jun 03 2017, pp. 444-459, doi: 10.1007/s12640-017-9756-3.

3. J. Lameth, D. Arnaud-Cormos, P. Leveque, S. Boillee, J. M. Edeline, and M. Mallat, "Effects of a Single Head Exposure to GSM-1800 MHz Signals on the Transcriptome Profile in the Rat Cerebral Cortex: Enhanced Gene Responses Under Proinflammatory Conditions," *Neurotox Res*, **38**, 1, Jun 2020, pp. 105- 123, doi: 10.1007/s12640-020-00191-3.