

FULL TEXT LINKS



Review [Neural Regen Res.](#) 2016 Dec;11(12):1888-1895. doi: 10.4103/1673-5374.195277.

Extremely low frequency electromagnetic fields stimulation modulates autoimmunity and immune responses: a possible immuno-modulatory therapeutic effect in neurodegenerative diseases

Fabio Guerriero ¹, Giovanni Ricevuti ¹

Affiliations

PMID: 28197174 PMCID: [PMC5270416](#) DOI: [10.4103/1673-5374.195277](#)

[Free PMC article](#)

Abstract

Increasing evidence shows that extremely low frequency electromagnetic fields (ELF-EMFs) stimulation is able to exert a certain action on autoimmunity and immune cells. In the past, the efficacy of pulsed ELF-EMFs in alleviating the symptoms and the progression of multiple sclerosis has been supported through their action on neurotransmission and on the autoimmune mechanisms responsible for demyelination. Regarding the immune system, ELF-EMF exposure contributes to a general activation of macrophages, resulting in changes of autoimmunity and several immunological reactions, such as increased reactive oxygen species-formation, enhanced phagocytic activity and increased production of chemokines. Transcranial electromagnetic brain stimulation is a non-invasive novel technique used recently to treat different neurodegenerative disorders, in particular Alzheimer's disease. Despite its proven value, the mechanisms through which EMF brain-stimulation exerts its beneficial action on neuronal function remains unclear. Recent studies have shown that its beneficial effects may be due to a neuroprotective effect on oxidative cell damage. On the basis of *in vitro* and clinical studies on brain activity, modulation by ELF-EMFs could possibly counteract the aberrant pro-inflammatory responses present in neurodegenerative disorders reducing their severity and their onset. The objective of this review is to provide a systematic overview of the published literature on EMFs and outline the most promising effects of ELF-EMFs in developing treatments of neurodegenerative disorders. In this regard, we review data supporting the role of ELF-EMF in generating immuno-modulatory responses, neuromodulation, and potential neuroprotective benefits. Nonetheless, we reckon that the underlying mechanisms of interaction between EMF and the immune system are still to be completely understood and need further studies at a molecular level.

Keywords: Alzheimer's disease; autoimmunity; electromagnetic fields; immunomodulation; transcranial magnetic stimulation.

Related information

[MedGen](#)

LinkOut - more resources

Full Text Sources

[Europe PubMed Central](#)

[Medknow Publications and Media Pvt Ltd](#)

[Ovid Technologies, Inc.](#)

[PubMed Central](#)

Other Literature Sources

[The Lens - Patent Citations](#)

[scite Smart Citations](#)

Miscellaneous

[NCI CPTAC Assay Portal](#)