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Article Summary: Neurostimulation Using Mechanical Motion of Magnetic Particles Wiggled by External Oscillating Magnetic Gradients

The hypothesis of this journal article was to determine if it was possible to use injected gold nanoparticles stimulated by an MRI machine to physically stimulate brain matter to a higher degree of precision, and compare this process to other methods e.g. "electrical stimulation, light activation, and focused ultrasound".

Instead of using gold nanoparticles they use a well studied and accepted gold analog (in the context of magnetic imaging excitation), that analog was manganese solution along with other particles, injected into a "well-described invertebrate model (juvenile crayfish) whose functional neuroimaging can be performed with high spatial resolution". The researchers had already recorded baseline imaging data, which showed symmetrical distribution of the analog (after 20 minutes). After the application of the targeted new process they were able to determine that the MRI [technically a manganese-enhanced magnetic resonance imaging (MEMI)] showed increased stimulation (uptake) caused by the focused MRI with higher precision using before and after MATLAB image processing.

The results demonstrated that new the process was successful, and only affected the targeted areas, since chemical uptake was "only present in the case where particles were present and oscillated with an external magnetic gradient". The potential uses are that by wiggling the nanoparticles they were able to affect the targeted areas which has shown in other studies creates a possible neuroprotective effect as a result of "ATP release (and subsequent local breakdown into adenosine". Thus demonstrating that the new process is superior because it provides higher precision, and does not stimulate tissue areas unintentionally as is the case with other methods e.g. "electrical stimulation, light activation, and focused ultrasound".

Reference

Nacev, Aleksandar, et al. “Neurostimulation Using Mechanical Motion of Magnetic Particles Wiggled by External Oscillating Magnetic Gradients.” 2017 8th International IEEE/EMBS Conference on Neural Engineering (NER), IEEE, 2017. Crossref, doi:10.1109/ner.2017.8008380. <https://ieeexplore.ieee.org/document/8008380>