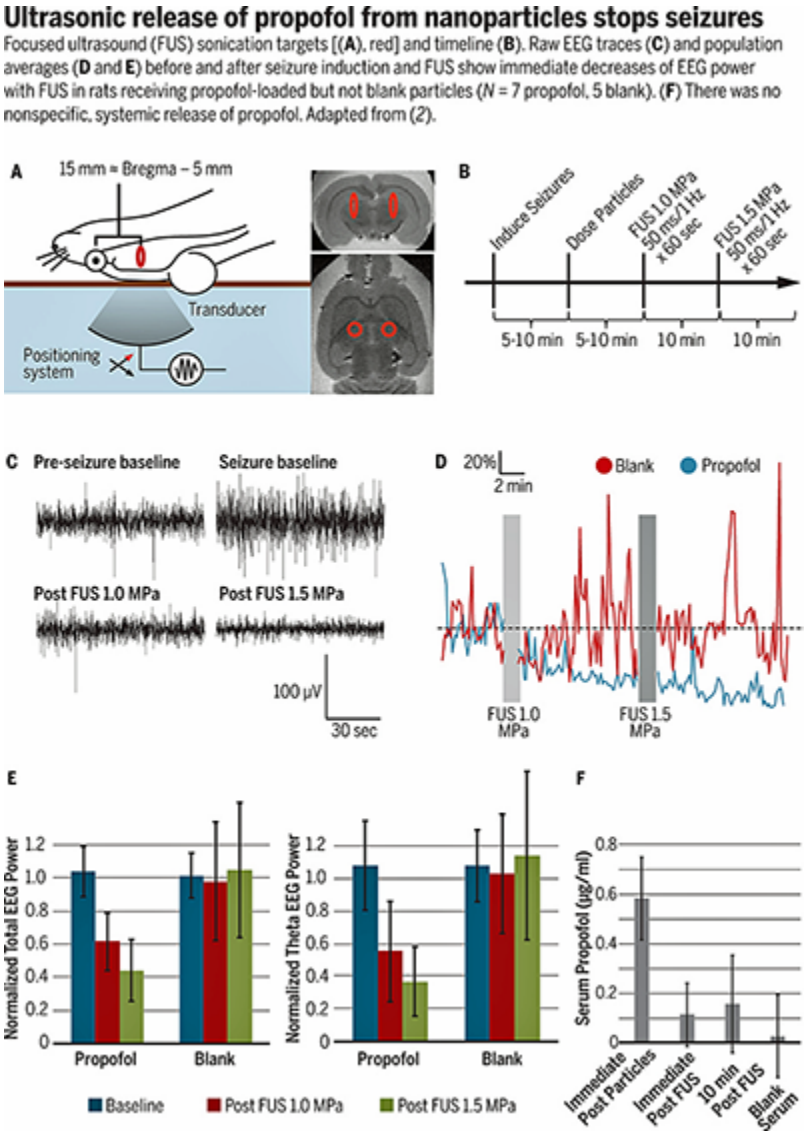
Docket #: S17-163

Phase-change nanoparticles for neuromodulation

Stanford researchers at the Airan Lab have developed a new method for robust and spatiotemporally precise non-invasive neuromodulation that could transform both basic and clinical neuroscience.
This technology focally releases drugs from nanoparticles within the brain and peripheral nervous system with the application of focused ultrasound. The system can encapsulate and deliver most any small molecule drug, especially lipophilic drugs that would normally cross the blood- brain barrier. This system is effective and safe. In addition, the particles can be produced in large scales with cGMP-compatible methods.

Figure



Stage of Research

- **Proof-of-principle** - Propofol used as test case
- Continued work towards clinical translation

Applications

- **Pre-surgical mapping** of functional brain regions to be resected
- **Pre-hoc validation** of a brain region to be intervened upon with, e.g., DBS, RFA, FUS, radiosurgery
- **Adjunctive focal pharmacotherapy for psychiatric treatment**
- **Scientific studies**

Advantages

- **Improves upon current neuromodulation methods:**
  - **More robust mechanism of action** than the direct application of ultrasound to brain for neuromodulation
  - **More spatially precise and increased depth of penetration** than TMS or tcDCS
  - **Less invasive** than DBS and other electrode-based methods
- **Can encapsulate and deliver most any small molecule drug**
- Particles amenable to large scale cGMP-compatible methods
- Safe and effective method

Publications

- Raag D. Airan, Randall A. Meyer, Nicholas P. K. Ellens, Kelly R. Rhodes, Keyvan Farahani, Martin G. Pomper, Shilpa D. Kadam, and Jordan J. Green. "Noninvasive Targeted Transcranial Neuromodulation via Focused Ultrasound Gated Drug Release from Nanoemulsions," Nano Letters, 2017.
- Airan, Raag. "Neuromodulation with nanoparticles." Science 357, no. 6350 (2017): 465-465.

Patents

- Published Application: WO2019036253
- Published Application: 20200368352
- Published Application: 20240293547

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