Docket #: S16-135

Tuning of reversible and irreversible electroporation lesions by manipulating pulse waveforms

Stanford researchers have developed a method that can tune the ratio between reversible (RE) and irreversible (IRE) electroporation through waveform adjustments. This is accomplished by altering the pulse waveform in such a way that one phenomena dominates over the other. These two phenomena typically overlap and there is no established method for targeting one therapy over the other.
This method also overcomes some challenges with electroporation including the elimination of muscle contractions and production of more predictable ablation volumes in vivo. Applications include improving in vivo gene therapy, delivery of chemotherapeutics, delivery of large molecules across the blood brain barrier, and the ablation of solid tumors.

Stage of Research

- Completed prototype electronics hardware and tested simulations
- Animal model studies
- Continued research to develop new methods for enhancing pulsed electric field therapies

Applications

- Electro-chemotherapy
- Electro-genetherapy
- Irreversible (IR) Electroporation (Bulk tumor ablation)
- Blood brain barrier disruption
- Synthetic biology (gene transfection)

Advantages

- Can tune between IR and IRE electroporation
- Ability to produce equivalent ablation sizes as commercial IRE techniques while eliminating muscle contractions seen in vivo and producing ablations which more closely match analytical predictions
- Ability to tune reversible ablation zones to enhance drug or gene delivery to large volumes while minimizing or eliminating lethal effects
- Ability to enhance drug delivery across the blood brain barrier while having a minimal effect on healthy brain tissue
- Ability to improve gene transfection efficiency and minimize cell killing

Publications

- Michael B. Sano, Richard E. Fan, and Lei Xing, "Asymmetric Waveforms Decrease Lethal Thresholds in High Frequency Irreversible Electroporation Therapies"; *Scientific Reports*; Article number:40747 (2017).

Patents

- Published Application: 20170348525
- Published Application: 20200171303
- Issued: 10,589,092 (USA)
- Issued: 10,994,133 (USA)

Innovators

- Michael Sano
- Lei Xing

Licensing Contact

Evan Elder

Associate Director, Licensing and Strategic Alliances, Physica

Email