Systems and Methods for Optical Stimulation of Neural Tissues (Portfolio)

VANDERBILT UNIVERSITY
CTTC Center for Technology Transfer & Commercialization

Summary

Vanderbilt researchers have developed a novel technique for contactless simulation of the central nervous system. This involves the use of infrared neural stimulation (INS) to evoke the observable action potentials from neurons of the central nervous system. While infrared neural stimulation of the peripheral nervous system was accomplished almost a decade ago, this is the first technique for infrared stimulation of the central nervous system.

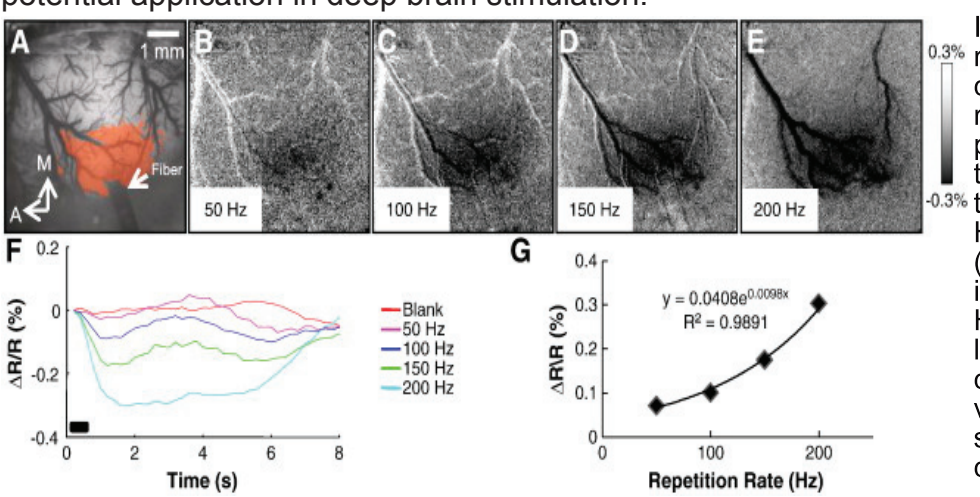
Addressed Need

» Electrical field spread in electrical stimulation excites too large of a volume of tissue and cannot provide local excitation.

» Electrical stimulation requires physical contact with tissue

Technology Description

Vanderbilt researchers have pioneered the application of pulsed infrared beams for stimulation of the peripheral nervous system and have now extended the application to the central nervous system. Since the observed physiological responses appear to be similar in magnitude to those resulting from tactile stimulation, there exists the promise of eventual application to study functional neural circuitry, including potential application in deep brain stimulation.



Intrinsic signals produced by different rates of INS. (A) Blood vessel map. Location of fiber optic is indicated by arrow. Orange pixels indicate significant pixels in t-test between 100 Hz stimulation and blank condition. (B–E) Activation maps of laser repetition rates: 50 Hz (B), 100 Hz (C), 150 Hz (D), 200 Hz (E). (F) Time course of response resulting from laser stimulation conditions 50 Hz (red), 100 Hz (blue), 150 Hz (yellow), and 200 Hz (aqua blue) and blank conditions. (G) Laser repetition rate vs. the peak amplitude of the intrinsic signal. Scale bar next to (E) indicates clipping range of images (B–E).

Competitive Advantages

» Can modulate intrinsic optical response for individual eye for potential functional stimulation testing

» Provides functional specifications for potential deep brain stimulation application

» Can be engineered to target a specific volume of tissue, due to penetration depth control

» Potential to stimulate a single neuron, due to improved spatial precision

» Contactless stimulation can be minimally invasive

Intellectual Property Status

» Issued US patents 6,921,413; 7,833,257; 7,951,181; 8,444,683; 8,498,699; 9,023,089; 9,044,596

» Link to Lab webpage & publications: http://research.vuse.vanderbilt.edu/bmeoptics/research/overview.htm

CTTC CONTACT:
Ashok Choudhury, Ph.D.
Phone: (615) 322-2503
ashok.choudhury@vanderbilt.edu

VANDERBILT LEAD INVENTORS:
Anita Mahadevan-Jansen, Ph.D.
E.Duco Jansen, Ph.D.
Professor of Biomedical Engineering and Neurological Surgery

VU REFERENCES: VU0108, VU04123, VU0607,VU0709, VU1055, VU11141