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High-Throughput Screening of Therapeutic Neural Stimulation Targets: Toward Principles of Preventing and Treating Post-Traumatic Stress Disorder

Principal Investigator: BOYDEN, EDWARD**Institution Receiving Award:** MASSACHUSETTS INSTITUTE OF TECHNOLOGY**Program:** PH-TBI**Proposal Number:** PT073473**Funding Mechanism:** PTSD Concept Award**Partnering Awards:****Award Amount:** \$252,000.00[View Technical Abstract](#)

PUBLIC ABSTRACT

Post-traumatic stress disorder (PTSD) is a debilitating disorder in which extreme anxiety and fear persist after a traumatic experience. Its effects can invade all the aspects of one's life, and it can be difficult to treat from traditional pharmacological and talk therapy standpoints. Other drug-resistant brain disorders have been explored using brain stimulation -- the use of electric and magnetic fields to alter brain activity in a targeted way. For example, in the United States, transcranial magnetic stimulation (TMS) was recently approved by the Food and Drug Administration for treating drug-resistant depression. These technologies offer the promise of altering activity in precise brain circuits, improving the underlying functions so that the human experience is improved. Unlike drug treatments, which commonly bathe the entire brain in a pharmaceutical, these brain stimulation technologies can focally alter activity in precisely the circuits in the brain that need alteration.

However, for PTSD, the circuits that need to be altered to cause lasting change are not known, and no brain stimulation therapy for PTSD yet exists. And, no existing technology lets you rapidly screen through targets in the living brain, to figure out which ones are ideal. Accordingly, we propose to develop a "high throughput screening" method for rapidly going through the brain and stimulating each site, allowing us to find the optimal targets faster. Using an animal model of PTSD, we will determine the optimal targets that, when stimulated, ameliorate or prevent PTSD.

We anticipate that we will determine locations in the brain that, when stimulated, can remedy the symptoms of PTSD. We will then be able to guide the use of technologies such as TMS and deep brain stimulation (DBS) to help treat patients. So far, the use of brain stimulation technologies has proceeded largely based upon purely clinical experimentation. However, it is difficult to optimize a protocol purely by human experiments, especially for a disorder like PTSD that may be very complex. We need to discover the principles of how to control these neural circuits. Accordingly, we expect, over the next several years, to generate a list of targets, and the protocols to stimulate them with, that will open up a new way to treat PTSD. We expect this information to guide the treatment of all patients with PTSD, but especially those for whom no existing treatments work -- a very large fraction of PTSD patients. Additionally, we expect to reveal principles for how to prevent PTSD -- something that has not been tried before, but which could be of great value.

As we find targets, we will collaborate with clinicians to translate these insights into the clinic. The Boston area provides for very rich interactions between neuroengineers, neuroscientists, neurologists, and psychiatrists. We think that in the years to come, we will be able to make a big impact on the treatment of PTSD by opening up new methodologies that can be used in a principled way.

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Last updated April 11, 2008 (ldm)
