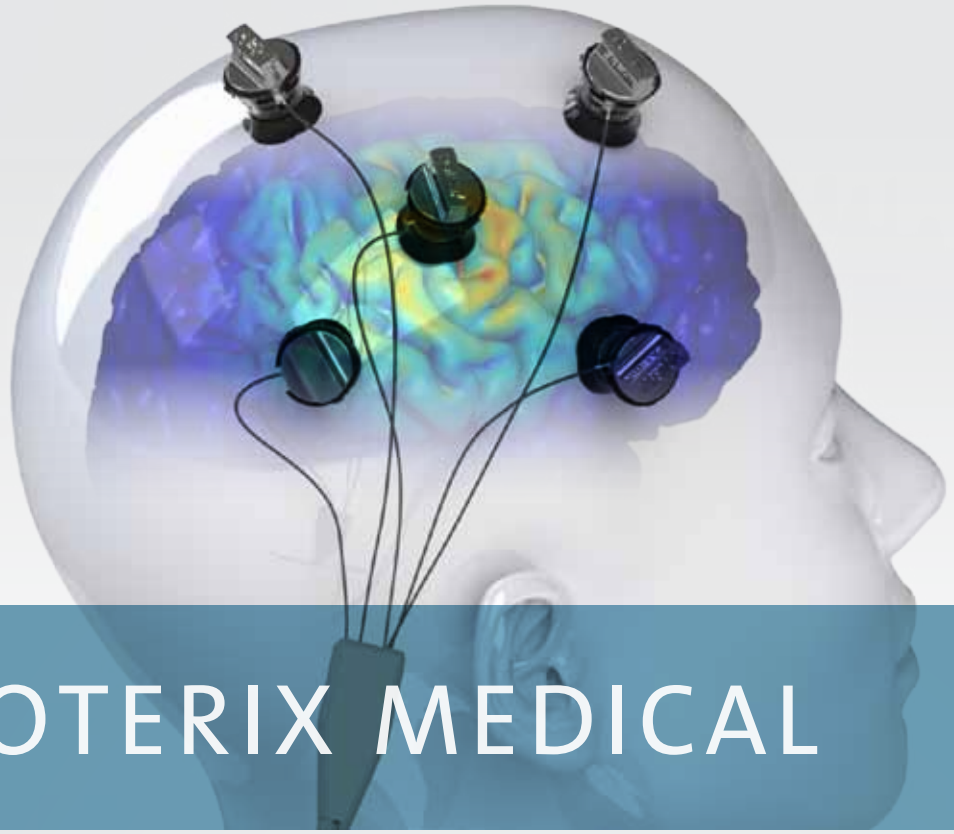


simpleware

SOTERIX MEDICAL

Success Story

"We use computational modelling, based heavily around Simpleware software, to prototype and verify new medical device performance. In applications spanning intra-operative surgical monitoring, physician simulators, and treatment for neurological and psychiatric disorders – it's critical to precisely simulate the interaction of technology with biology for the purpose of optimization design prior to clinical testing."

Dr Marom Bikson,
Soterix Medical

Thanks to:

BETTER. SMARTER.
Soterix medical

Developing Design Protocols for Innovative Neuromodulation Hardware

Overview

Transcranial direct current stimulation (tDCS) is a promising method for treating neurological disorders and probing brain functionality. tDCS is non-invasive, simple-to-apply using clinical grade devices and considered well-tolerated. A tDCS device sends a low-level direct current (DC) across the scalp to modulate and target specific brain functions.

The technology has many applications, including as a therapy for depression, chronic pain, schizophrenia, ADHD and other psychiatric conditions, and as a tool to promote stroke rehabilitation. Recent technological advances have leveraged Simpleware modelling tools to enhance the design of tDCS devices.

Soterix Medical is a spin-off company from the City College of New York (CCNY) that develops proprietary tDCS hardware. The efficiency and safety of Soterix Medical devices is based on research from the Neural Engineering Group at CCNY. Researchers employ Simpleware software to generate 3D models for simulating medical device performance and to design patient-specific therapy protocols for clinicians using Soterix Medical devices.

At a Glance

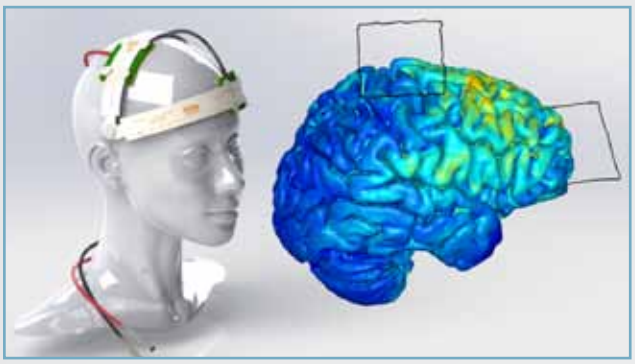
» Development of high-quality models of the brain, skull and electrodes

» Models used to simulate tDCS and Soterix designs

» Non-invasive testing looks at how the brain responds to electrical currents

IMPROVING DEVICE DESIGNS USING COMPUTATIONAL MODELLING

One of the key challenges of tDCS technology involves ensuring that hardware is fully tested and optimised to suit different tasks. Computational modelling enables researchers to carry out extensive simulations of medical devices before any subject testing. Only verified designs are then validated in clinical trials. When designing new therapies, simulation accuracy is crucial to understanding how devices interact with the human body.

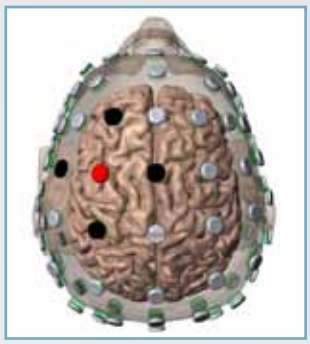


GENERATING 3D MODELS

Simpleware software provides a robust and efficient pipeline to generate 3D models for simulating tDCS and Soterix designs; this involves working with scan data to obtain high-quality models of the brain, skull and electrodes. Dr Bikson has explained the benefits of using the software for this purpose, whereby *"Simpleware allows incorporation of imaging derived anatomy, for example from MRI, with rendered devices, and generation of data formats supporting numerical simulation of interaction between the devices and physiology"*.

MESH GENERATION AND SIMULATION OF CURRENT FLOW

Computational models generated using Simpleware software that include tissue and electrode montages are used in finite element (FE) software packages such as COMSOL Multiphysics® to test how the brain responds to electrical currents. These models provide a basis for simulating the effects of tDCS, helping researchers and designers to understand device performance prior to manufacturing.



OPTIMISING MEDICAL DEVICES

Carrying out this kind of virtual testing with computational models is essential for the ongoing development of Soterix Medical devices. By taking advantage of the latest scan, 3D modelling and simulation technologies, researchers can create protocols for clinical trials, ensuring that clinicians have clear data to work with when applying tDCS technology. According to Dr Bikson:

"Soterix Medical Inc. has adapted such designs for devices in clinical trials in over 200 medical centers, meaning thousands of patients are enrolled in clinical trials with devices designed using Simpleware. The success of these trials is linked to the quality and flexibility of Simpleware software."