

## **Developing novel and effective non-drug therapies for Tourette syndrome based upon tic prediction and non-invasive brain stimulation (NiBS)**

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Awarded £120,867

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### **SUMMARY**

Major accomplishments within the life of this grant were to use multiple converging brain imaging techniques to identify the brain networks that give rise to tics and to the urge-to-tic, and then, based on this information, to develop a neuromodulation therapeutic approach that involved delivering mild rhythmic electrical stimulation to the peripheral nervous system through a unobtrusive wearable 'watch-like' device. We demonstrated that this neuromodulation approach was extremely effective in reducing tic frequency and tic severity in individuals with Tourette syndrome. The early and continued funding that we have received from Tourettes Action was critical in kick-starting our research on this topic. We subsequently secured larger grants to continue and develop our research, which allowed us to conduct a UK-wide double-blind placebo-controlled clinical trial of the effectiveness of home-administered peripheral nerve stimulation for reducing tics in Tourette syndrome. This study, which has now been published, demonstrated clearly that active stimulation produced a clinically relevant reduction in tic frequency relative to sham (placebo) stimulation. This research paves the way for the development of a safe, effective, and novel treatment approach, that can be used outside of the clinic in the community, and offers substantial reduction of tics at the touch of a button.

### **Click here for the links to publications:**

- [Comparing GABA-dependent physiological measures of inhibition with proton magnetic resonance spectroscopy measurement of GABA using ultra-high-field MRI - PubMed \(nih.gov\)](#)
- [The role of the insula in the generation of motor tics and the experience of the premonitory urge-to-tic in Tourette syndrome - PubMed \(nih.gov\)](#)
- [Alterations in cerebellar grey matter structure and covariance networks in young people with Tourette syndrome - PubMed \(nih.gov\)](#)
- [A feasibility study for somatomotor cortical mapping in Tourette syndrome using neuronavigated transcranial magnetic stimulation - PubMed \(nih.gov\)](#)
- [Examining the neural antecedents of tics in Tourette syndrome using electroencephalography - Morera Maiquez - 2022 - Journal of Neuropsychology - Wiley Online Library](#)

- [The role of the cingulate cortex in the generation of motor tics and the experience of the premonitory urge-to-tic in Tourette syndrome - PubMed \(nih.gov\)](#)
- [Non-invasive brain stimulation as therapy: systematic review and recommendations with a focus on the treatment of Tourette syndrome - PubMed \(nih.gov\)](#)
- [Task-Dependent Plasticity in Distributed Neural Circuits after Transcranial Direct Current Stimulation of the Human Motor Cortex by Duncan Jack Hodgkinson, Stephen Jackson, JeYoung Jung :: SSRN](#)
- [A double-blind, sham-controlled, trial of home-administered rhythmic 10-Hz median nerve stimulation for the reduction of tics, and suppression of the urge-to-tic, in individuals with Tourette syndrome and chronic tic disorder - PubMed \(nih.gov\)](#)
- Caitlin M. Smith, Hilmar P. Sigurdsson, Katherine Dyke, Rosa Sanchez Panchuelo, Susan T. Francis, Georgina M. Jackson, Stephen R. Jackson (2022). Somatomotor cortical mapping in Tourette syndrome using neuro-navigated transcranial magnetic stimulation. *International Review of Movement Disorders*, 2666-7878. Book chapter. The Neurobiology of the Gilles De La Tourette Syndrome and Chronic Tics book Edited by Marc E. Lavoie and Andrea E. Cavanna
- \*Mairi Houlgreave, Bàbara Morera Maiquez, Katherine Dyke, Georgina Jackson, Stephen Jackson (2022). Entrainment of movement-related brain oscillations to improve symptoms in Tourette syndrome. *International Review of Movement Disorders*, 2666-7878. Book chapter. The Neurobiology of the Gilles De La Tourette Syndrome and Chronic Tics book Edited by Marc E. Lavoie and Andrea E. Cavanna