

Behavioral and Systems Neuroscience 神經科學中心實驗室

What's new in the UBSN website?

- List of selected publications of UBSN PIs
- UBSN orientation video

Coming soon



Magnetic Resonance Imaging (MRI)

The UBSN is setting up a new human MRI system. The state-of-the-art, research-dedicated, whole-body 3T Siemens Prisma scanner arrived at PolyU on September 14, 2020. Internal building works are in full gear. Please contact our staff for details.

Director's message

Time flies! UBSN has marched into its fourth year of operation. We welcome our new faculty members with backgrounds in neuroscience. They further strengthen our capacity to conduct high-quality neuroscience research. I am pleased to share with you that the building of the human MRI centre is making good progress. Our target is to set the scanner in operation in early 2021. In the meantime, let us know what we can do to further support your research endeavour!



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NEWSLETTER

Transcranial magnetic stimulation – A new therapeutic approach for treating depression and obsessive-compulsive disorder

What is transcranial magnetic stimulation (TMS)?

TMS is a noninvasive procedure in which neurons in the brain are stimulated by weak electric current generated by electromagnetic induction. It aims to produce both immediate and long-term changes in neuronal activity. TMS therapies on treating major depressive disorder and obsessive-compulsive disorder have been cleared by the U.S. Food and Drug Administration (FDA), suggesting the validity of its medical use.

How it works

There are two major components in a TMS system: the stimulator and the coil. The stimulator is the control unit that adjusts stimulation parameters, such as pulse mode, repetition rate, and waveform. Meanwhile, the coil determines stimulation characteristics, such as electric field focality and depth.

By manipulating the type of coil used, its position, and the stimulation parameters, a specific region of the brain can be stimulated. Additional modules, such as the Localite TMS Navigator, can be used for precise coil positioning and monitoring.



TMS coil



TMS stimulator

Further reading on TMS:

Blumberger *et al.* (2018). Effectiveness of theta burst versus high-frequency repetitive transcranial magnetic stimulation in patients with depression (THREE-D): a randomised non-inferiority trial. *The Lancet* 391, 1683–1692.

This study examined the effectiveness of two major TMS protocols on patients with treatment-resistant depression: repetitive TMS (rTMS) and intermittent theta burst stimulation (iTBS). The results suggest that, with similar effectiveness of both protocols, iTBS provided a faster and shorter treatment regime than rTMS.

Interview with Dr. Georg Kranz (Department of Rehabilitation Sciences)

Would you please briefly describe your research work using TMS?

I am interested in the application and optimization of TMS as a treatment tool for neuropsychiatric disorders. In my team, we explore the efficacy of different stimulation parameters and their underlying neural processes. For example, in one study, we systematically investigate the meta-plastic effects of priming thetaburst stimulation (TBS), a potent form of repetitive TMS. To determine stimulation-induced brain activity changes, we use functional near-infrared spectroscopy (fNIRS). In another study, we use concurrent TBS/fNIRS in order to provide mechanistic evidence of the direct effects of TBS on healthy and presumed neuropathological prefrontal cortex. Here, our aim is to explore whether the immediate excitability modulation of the prefrontal cortex is a biomarker for antidepressant treatment response. Patients with major depressive disorder are recruited through collaboration with the Prince of Wales Hospital and Kowloon Hospital.

How would you expect TMS to benefit patients?

The benefits of therapeutic TMS can be divided into three elements:

Specificity – Many psychiatric disorders are associated with specific dysregulations of prefrontal cortex activity. By modulating these specific pathways, TMS can target dysfunctional cognitive control and related clinical symptoms across diagnoses.

A safe alternative – About a third of depressed patients do not respond to standard pharmacological treatment or psychotherapy. The weight of the evidence suggests that TMS is effective for the treatment of many psychiatric symptoms that are otherwise refractory to standard treatments.

Feasibility – TMS treatment has a low side-effect profile, is well tolerated, and can be provided as outpatient service. TMS treatment is an increasingly practical intervention and already provided in several clinics in Hong Kong.

What are the unique advantages of TMS compared with other neuroscience methods?

In combination with neuroimaging, TMS can show how information is transmitted in the brain. TMS can augment or inhibit brain activity as well as interfere with ongoing brain function, creating "virtual lesions." Hence, TMS is a neuroscientific tool that permits the investigation of *causal* relationships between brain regions and between specific brain functions and mental processes.

Specification of TMS in UBSN:

MagVenture MagPro X100 with MagOption

- Max. repetition rate: 100 pps
- Pulse mode: Standard, Dual, Twin, Power
- Waveform: Biphasic, Monophasic, Theta Burst, Half-sine
- Equipped with Localite TMS Navigator



Dr. Georg Kranz showing TMS

Recent publication on TMS by Dr. Kranz

Zhang JJQ, Fong KNK, Ouyang RG, Siu AMH, Kranz GS (2019). Effects of repetitive transcranial magnetic stimulation (rTMS) on craving and substance consumption in patients with substance dependence: A systematic review and meta-analysis. *Addiction* 114, 2137–2149.

Interested in using our equipment? Please contact us: