

SIG on NBS

The Executive Committee of the International Federation of Clinical Neurophysiology (IFCN) has recently committed Prof. Yoshikazu Ugawa (Department of Neuro-regeneration, Fukushima Medical University, Japan) and Prof. Walter Paulus (Department of Clinical Neurophysiology, University of Göttingen, Germany) to lead activities of a Special Interest Group (SIG) on non-invasive brain stimulation (NBS) techniques, such as transcranial magnetic stimulation (TMS), transcranial direct and alternating current stimulation (tDCS, tACS) as well as static magnetic stimulation, ultrasound stimulation and others, with in the beginning around 50 international experts for the development of new stimulation methods or new clinical application of NBS, and also the propaganda of established techniques of NBS (CMCT, SICI, SIF, SICF, CBI and others) in Clinical Neurophysiology. During the 31st International Congress of Clinical Neurophysiology (ICCN2018) held in Washington D.C. (USA, May the 4th 2018), we have a small session of SIG on NBS focusing on the spinal cord plasticity induction methods. Two speakers gave a talk about spinal cord plasticity induction.

Theta burst stimulation for modulating spinal plasticity. Dr Ying-Zu Huang, Medical School, Chang Gung University, Neuroscience Research center & Dept of Neurology, Chang Gung Memorial Hospital, Taiwan

Prof. Huang first introduced the protocols and underlying mechanisms of theta burst stimulation (TBS) that were originally developed for transcranial magnetic stimulation (TMS). He then explained how and why he adapted the TBS protocol to stimulate the median nerve with electric currents instead of TMS to induce plasticity in the mono-synaptic H-reflex within the spinal cord. The effects of electric TBS on spinal plasticity could be adjusted by changing the stimulus intensity. Furthermore, he demonstrated how the spinal plasticity in the disynaptic circuit induced by periodic electrical stimulation was modulated by TBS and anodal transcranial direct current stimulation over the primary motor cortex.

In the discussion, it was mainly questioned whether the depressive effect caused by electric TBS on the H-reflex could be due to a 'fatigue' effect. Since there was no muscle activity during TBS given at a subthreshold intensity, peripheral fatigue is not likely. An extra experiment showing no post-activation depression suggesting no fatigue, which could be cause by pre-synaptic vesicle depletion in the circuits. Moreover, in the study, higher intensity induced facilitation instead of depression implies that fatigue cannot be the cause of the effect.

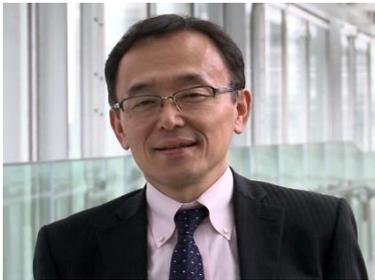
Spike-timing dependent bidirectional plasticity in the human spinal motoneurons. Takenobu Murakami, Department of Neurology, School of Medicine, Fukushima Medical University, Japan

Dr. Murakami presented induction of synaptic plasticity at spinal motoneurons (SMs) using a modified PAS protocol, namely SM-PAS. SM-PAS consists of a pair of TMS over the primary motor cortex with electrical nerve stimulation (ES) at the contralateral wrist. He and his colleagues performed SM-PAS (180 pairs at 0.2 Hz) at different intervals of TMS and ES pairing and reported successful induction of plasticity at the corticospinal-motoneuronal synapses. He noted that direction of the induced plasticity is dependent on the estimated intervals at the corticospinal-motoneuronal synapses. Dr Murakami proposed that their results should be produced by a kind of

spike time dependent plasticity at the corticospinal-motoneuronal synapses. The discussions proposed that more precise experiments should be needed to make a conclusion about the site of plasticity induction.

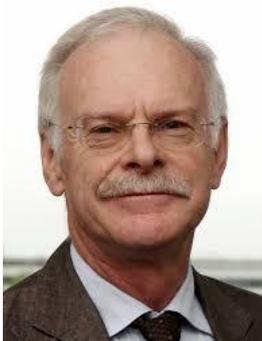
Prof. Ugawa briefly explained the concept of SIG on NBS of IFCN. Two main aims of this SIG and some proposed actions are as follows.

- **To develop new NBS methods and discuss their mechanisms** in collaboration with other societies or groups. We would like to include Static Magnetic Stimulation and Ultrasound Stimulation in addition to TMS, tDCS and tACS. We will cooperate to organize some meetings about NBS with other organizations, such as Brain Stimulation Journal meeting or NBS meetings in the past in Göttingen.
- **To propagate established NBSs** in chapters or areas where NBSs are not widely used. We will make small workshops on NBSs, especially on clinical matters, in countries in Asian, South America and African regions.



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