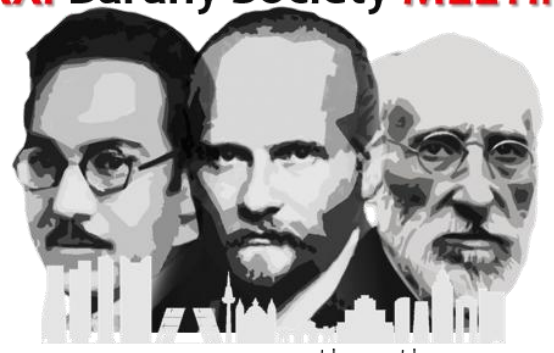
XXXI Bárány Society MEETING



MADRID, MAY 9th-11th 2022

SP08

XXXI Bárány Society MEETING

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SYMPOSIUM FORM

- ORGANIZER'S NAME and SURNAME: Aasef G. Shaikh
- ORGANIZER'S E-MAIL: aasefshaikh@gmail.com
- ACADEMIC/HOSPITAL AFFILIATION: Case Western Reserve University
- SESSION TITLE: Novel ways to modulate the vestibular system -- magnetic vestibular stimulation and deep brain stimulation.

3 or 4 SPEAKERS PER SYMPOSIUM:

- SPEAKER 1
  NAME AND SURNAME: Dr. Bryan K. Ward
  TOPIC DESCRIPTIVE TITLE: Magnetic vestibular stimulation (MVS) - physiology and mechanistic underpinning
  ACADEMIC / HOSPITAL AFFILIATION: Department of Otorhinolaryngology, Johns Hopkins School of Medicine, Baltimore, MD, USA

- SPEAKER 2
  NAME AND SURNAME: Dr. Aasef G. Shaikh
  TOPIC DESCRIPTIVE TITLE: Deep brain stimulation (DBS) of the central vestibular system
  ACADEMIC / HOSPITAL AFFILIATION: Department of Neurology, Case Western Reserve University, Cleveland, OH, USA

- SPEAKER 3
  NAME AND SURNAME: Dr. Alexander Andrea Tarnutzer
  TOPIC DESCRIPTIVE TITLE: MVS and DBS in clinical neurotology - are we there yet?
  ACADEMIC / HOSPITAL AFFILIATION: Neurology, Cantonal Hospital of Baden, Baden, Switzerland

- SPEAKER 4
  NAME AND SURNAME: Click here to write
  TOPIC DESCRIPTIVE TITLE: Click here to write
  ACADEMIC / HOSPITAL AFFILIATION: Click here to write

- **A BRIEF** (<300 WORDS) DESCRIPTION OF THE THEME AND TARGET AUDIENCE:

Advances in neurotechnologies has offered a new dynamic picture of the brain revolutionizing our understanding of complex neural circuits and has enabled us to seek for new ways to treat disorders of human brain. In vestibular system the artificial stimulation of inner ear endorgans, the vestibular prosthesis, and magnetic or electrical non-invasive modulation of the cerebellum or cortex (i.e., transcranial magnetic and direct current stimulation) had provided evidence to experimentally and clinically change the way our brain manages the sensation of self-motion. Recently two serendipitous observations informed us that it is possible to modulate peripheral and central vestibular system in a completely different way. One is called magnetic vestibular stimulation (MVS), while the other is deep brain stimulation (DBS). Proof of principle underlying MVS comes from the fact that individuals working next to strong static magnetic fields occasionally feel disoriented. Theoretically, magnetic field interacts with naturally occurring ionic current flowing through the inner ear resulting in the Lorentz force displacing the endolymph generating sensation of constant acceleration rotation. Dr.Ward will discuss physiology and physics underlying MVS. We learnt that Parkinson patients undergoing DBS for surgical treatment of their motor symptoms often feel electric stimulation dependent vertigo. This serendipitous finding led to novel discovery that DBS in the dorsal aspect of

subthalamus modulates central vestibular pathways that carry motion perception information via influencing the cerebellar outflow, indirectly via subthalamo-cerebellar projections and directly via modulating cerebello-thalamic fibers (that are in proximity to the subthalamus). Dr.Shaikh will discuss physiology, psychophysics, neuroimaging, and computational modeling data explaining the mechanistic underpinning of DBS influencing the central vestibular system. The application of MVS and DBS in treatment of vertigo and dizziness is still far from clinical practice. Dr.Tarnutzer will provide clinician's perspective on application these novel modality in dizzy patients.

- A 150-WORD **ABSTRACT FROM EACH OF THE SPEAKERS:**

ABSTRACT 1

Mammals experience vertigo and nystagmus in strong MRI machines. The effect is believed to be the result of a Lorentz force generated by interactions of the normal vestibular ion currents and the strong magnetic field of the MRI machine, and pressing on the semicircular canal cupulae. This magnetic vestibular stimulation (MVS) constantly displaces the semicircular canal cupulae, delivering a force similar to constant acceleration, while a human lies comfortably in an MRI machine. The nystagmus partially adapts in the MRI, and upon exiting the MRI, an after effect emerges in which the nystagmus reverses direction. By measuring how the nystagmus adapts during MVS, we can learn how the brain adapts to a new set-point. Dr. Bryan Ward will discuss the mechanism of MVS, what we have learned about vestibular set-point adaptation, and the advantages and disadvantages of using MVS as a tool for studying the vestibular system.

ABSTRACT 2

Deep brain stimulation (DBS) is a state-of-art treatment of debilitating movement disorders such as Parkinson's disease. While optimizing subthalamic nucleus DBS for the treatment of Parkinson we observed that subject experienced stimulation dependent vertigo. This findings resulted in multi-displinary research examining the effects of subthalamic deep brain stimulation on human motion perception on variety of subtypes of Parkinson patients who already had DBS implant. Over last five years, in experiments using pure vestibular heading perception, pure visual heading perception, and visual scanning behavior combined with patient-specific DBS volume of tissue activation models, we discovered a fundamental role of specific subthalamic nucleus region and cerebellar-thalamic projection when the subthaalmic DBS modulates motion perception. This novel results are not only critical to better treat disroders of balance and falls in Parkionson's disease, but also provide important insights for future treatments of mysterious central vestibular disroders presenting with intractable perception of vertigo.

ABSTRACT 3

Neuromodulation offers unique adjustable way to control signal transduction through the nervous system. While standard-of-care for some neurological indications, neuromodulation strategy is in infancy for clinical application or confined to research laboratories. Vestibular system is one of such examples. In last one decade a novel way to modulate the vestibular labyrinth, magnetic vestibular system, was identified. Several years later it was discovered that deep brain stimulation can also modulate vestibular perception. While these novel interventions are already tested in humans, their stand-alone application for the treatment of perceptual balance dysfunction needs more evidence before used for primary application in clinical neurotology. We will discuss which human disorders could be ideal responders for the magnetic vestibular stimulation and which ones would respond better to the deep brain stimulation. We will discuss various (speculated) pathways to reach the ultimate goal of its application for the treatment of disorders affecting the vestibular system.

ABSTRACT 4

Click here to write.